

Shop Manual



KOMATSU

PC160LC-7E0

PC180LC-7E0

PC180NLC-7E0

	PC160LC-7E0	K45001	
SERIAL NUMBERS	PC180LC-7E0	K45001	and up
	PC180NLC-7E0	K45001	

KOMATSU

HYDRAULIC EXCAVATOR

PC160LC-7E0
PC180LC-7E0
PC180NLC-7E0

Machine model	Serial number
PC160LC-7E0	K45001 and up
PC180LC-7E0	K45001 and up
PC180NLC-7E0	K45001 and up

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Composition of shop manual

The contents of this shop manual are shown together with Form No. in a list.

Note 1: Always keep the latest version of this manual in accordance with this list and utilize accordingly.

The marks shown to the right of Form No. denote the following:

○: New issue (to be filed additionally) ●: Revision (to be replaced for each Form No.)

Note 2: This shop manual can be supplied for each Form No.

Note 3: To file this shop manual in the special binder for management, handle it as follows:

- Place a divider on the top of each section in the file after matching the Tub No. with No. indicated next to each Section Name shown in the table below:
- File overview and other materials in sections in the order shown below and utilize them accordingly.

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PC160LC-7E0, PC180LC/NLC-7E0 Hydraulic excavator

Form No. UEN01894-04

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Printed in Belgium 06-08 (03)

HYDRAULIC EXCAVATOR

PC160LC-7E0

PC180LC-7E0

PC180NLC-7E0

Machine model	Serial number
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PC160LC-7E0	K45001 and up
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Safety notice


(Rev. 2006/09)

Important safety notice

Proper service and repair are extremely important for safe machine operation. The service and repair techniques recommended by Komatsu and described in this manual are both effective and safe. Some of these techniques require the use of tools specially designed by Komatsu for the specific purpose.

To prevent injury to workers, the symbol  is used to mark safety precautions in this manual. The cautions accompanying these symbols should always be followed carefully. If any dangerous situation arises or may possibly arise, first consider safety, and take the necessary actions to deal with the situation.

1. General precautions

 **Mistakes in operation are extremely dangerous. Read the Operation and Maintenance Manual carefully before operating the machine.**

- 1) Before carrying out any greasing or repairs, read all the safety plates stuck to the machine. For the locations of the safety plates and detailed explanation of precautions, see the Operation and Maintenance Manual.
- 2) Decide a place in the repair workshop to keep tools and removed parts. Always keep the tools and parts in their correct places. Always keep the work area clean and make sure that there is no dirt, water, or oil on the floor. Smoke only in the areas provided for smoking. Never smoke while working.
- 3) When carrying out any operation, always wear safety shoes and helmet. Do not wear loose work clothes, or clothes with buttons missing.
 - Always wear safety glasses when hitting parts with a hammer.
 - Always wear safety glasses when grinding parts with a grinder, etc.
- 4) When carrying out any operation with 2 or more workers, always agree on the operating procedure before starting. Always inform your fellow workers before starting any step of the operation. Before starting work, hang UNDER REPAIR warning signs in the operator's compartment.
- 5) Only qualified workers must carry out work and operation which require license or qualification.
- 6) Keep all tools in good condition, learn the correct way to use them, and use the proper ones of them. Before starting work, thoroughly check the tools, machine, fork-lift, service car, etc.

- 7) If welding repairs are needed, always have a trained and experienced welder carry out the work. When carrying out welding work, always wear welding gloves, apron, shielding goggles, cap and other clothes suited for welding work.
- 8) Before starting work, warm up your body thoroughly to start work under good condition.

Safety points

1	Good arrangement
2	Correct work clothes
3	Following work standard
4	Making and checking signs
5	Prohibition of operation and handling by unlicensed workers
6	Safety check before starting work
7	Wearing protective goggles (for cleaning or grinding work)
8	Wearing shielding goggles and protectors (for welding work)
9	Good physical condition and preparation
10	Precautions against work which you are not used to or you are used to too much

2. Preparations for work

- 1) Before adding oil or making any repairs, park the machine on hard and level ground, and apply the parking brake and block the wheels or tracks to prevent the machine from moving.
- 2) Before starting work, lower the work equipment (blade, ripper, bucket, etc.) to the ground. If this is not possible, insert the lock pin or use blocks to prevent the work equipment from falling. In addition, be sure to lock all the control levers and hang warning signs on them.

- 3) When disassembling or assembling, support the machine with blocks, jacks, or stands before starting work.
- 4) Remove all mud and oil from the steps or other places used to get on and off the machine. Always use the handrails, ladders or steps when getting on or off the machine. Never jump on or off the machine. If it is impossible to use the handrails, ladders or steps, use a stand to provide safe footing.

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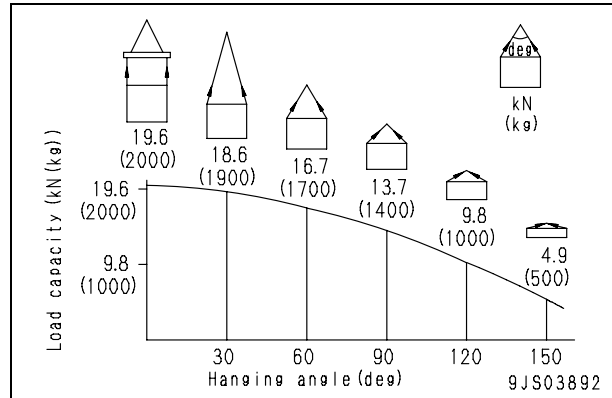
- 1) Before disconnecting or removing components of the oil, water, or air circuits, first release the pressure completely from the circuit. When removing the oil filler cap, a drain plug, or an oil pressure pickup plug, loosen it slowly to prevent the oil from spurting out.
- 2) The coolant and oil in the circuits are hot when the engine is stopped, so be careful not to get scalded. Wait for the oil and coolant to cool before carrying out any work on the oil or water circuits.
- 3) Before starting work, stop the engine. When working on or around a rotating part, in particular, stop the engine. When checking the machine without stopping the engine (measuring oil pressure, revolving speed, temperature, etc.), take extreme care not to get rolled or caught in rotating parts or moving parts.
- 4) Before starting work, remove the leads from the battery. Always remove the lead from the negative (–) terminal first.
- 5) When raising a heavy component (heavier than 25 kg), use a hoist or crane. Before starting work, check that the slings (wire ropes, chains, and hooks) are free from damage. Always use slings which have ample capacity and install them to proper places. Operate the hoist or crane slowly to prevent the component from hitting any other part. Do not work with any part still raised by the hoist or crane.
- 6) When removing a cover which is under internal pressure or under pressure from a spring, always leave 2 bolts in diagonal positions. Loosen those bolts gradually and alternately to release the pressure, and then remove the cover.
- 7) When removing components, be careful not to break or damage the electrical wiring. Damaged wiring may cause electrical fires.
- 8) When removing piping, stop the fuel or oil from spilling out. If any fuel or oil drips onto the floor, wipe it up immediately. Fuel or oil on the floor can cause you to slip and can even start fires.
- 9) As a general rule, do not use gasoline to wash parts. Do not use it to clean electrical parts, in particular.
- 10) Be sure to assemble all parts again in their original places. Replace any damaged parts and parts which must not be reused with new parts. When installing hoses and wires, be sure that they will not be damaged by contact with other parts when the machine is operated.
- 11) When installing high pressure hoses, make sure that they are not twisted. Damaged tubes are dangerous, so be extremely careful when installing tubes for high pressure circuits. In addition, check that connecting parts are correctly installed.
- 12) When assembling or installing parts, always tighten them to the specified torques. When installing protective parts such as guards, or parts which vibrate violently or rotate at high speed, be particularly careful to check that they are installed correctly.
- 13) When aligning 2 holes, never insert your fingers or hand. Be careful not to get your fingers caught in a hole.
- 14) When measuring hydraulic pressure, check that the measuring tools are correctly assembled.
- 15) Take care when removing or installing the tracks of track-type machines. When removing the track, the track separates suddenly, so never let anyone stand at either end of the track.
- 16) If the engine is operated for a long time in a place which is not ventilated well, you may suffer from gas poisoning. Accordingly, open the windows and doors to ventilate well.

4. Precautions for sling work and making signs

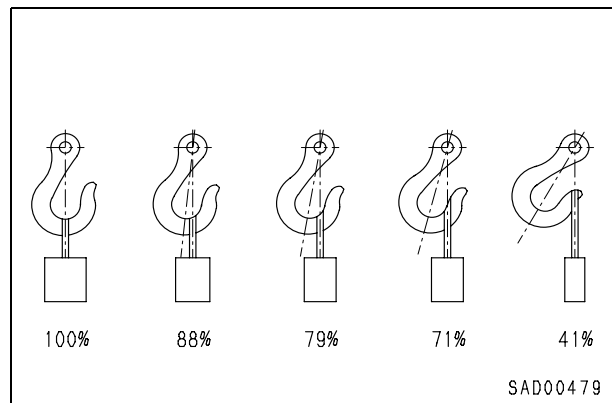
- 1) Only one appointed worker must make signs and co-workers must communicate with each other frequently. The appointed sign maker must make specified signs clearly at a place where he is seen well from the operator's seat and where he can see the working condition easily. The sign maker must always stand in front of the load and guide the operator safely.
 - Do not stand under the load.
 - Do not step on the load.
- 2) Check the slings before starting sling work.
- 3) Keep putting on gloves during sling work. (Put on leather gloves, if available.)
- 4) Measure the weight of the load by the eye and check its centre of gravity.
- 5) Use proper sling according to the weight of the load and method of slinging. If too thick wire ropes are used to sling a light load, the load may slip and fall.
- 6) Do not sling a load with 1 wire rope alone. If it is slung so, it may rotate and may slip out of the rope. Install 2 or more wire ropes symmetrically.

⚠ Slings with 1 rope may cause turning of the load during hoisting, untwisting of the rope, or slipping of the rope from its original winding position on the load, which can result in a dangerous accident.

- 7) Limit the hanging angle to 60°, as a rule. Do not sling a heavy load with ropes forming a wide hanging angle from the hook. When hoisting a load with 2 or more ropes, the force subjected to each rope will increase with the hanging angle. The table below shows the variation of allowable load in kN {kg} when hoisting is made with 2 ropes, each of which is allowed to sling up to 9.8 kN {1,000 kg} vertically, at various hanging angles. When the 2 ropes sling a load vertically, up to 19.6 kN {2,000 kg} of total weight can be suspended. This weight is reduced to 9.8 kN {1,000 kg} when the 2 ropes make a hanging angle of 120°. If the 2 ropes sling a 19.6 kN {2,000 kg} load at a lifting angle of 150°, each of them is subjected to a force as large as 39.2 kN {4,000 kg}.



- 8) When installing wire ropes to an angular load, apply pads to protect the wire ropes. If the load is slippery, apply proper material to prevent the wire rope from slipping.
- 9) Use the specified eyebolts and fix wire ropes, chains, etc. to them with shackles, etc.
- 10) Apply wire ropes to the middle portion of the hook.
 - Slings near the tip of the hook may cause the rope to slip off the hook during hoisting. The hook has the maximum strength at the middle portion.




- 11) Do not use twisted or kinked wire ropes.
- 12) When lifting up a load, observe the following.
 - Wind in the crane slowly until wire ropes are stretched. When settling the wire ropes with the hand, do not grasp them but press them from above. If you grasp them, your fingers may be caught.
 - After the wire ropes are stretched, stop the crane and check the condition of the slung load, wire ropes, and pads.

- If the load is unstable or the wire rope or chains are twisted, lower the load and lift it up again.
 - Do not lift up the load slantingly.
- 13) When lifting down a load, observe the following.
- When lifting down a load, stop it temporarily at 30 cm above the floor, and then lower it slowly.
 - Check that the load is stable, and then remove the sling.
 - Remove kinks and dirt from the wire ropes and chains used for the sling work, and put them in the specified place.

5. Precautions for using mobile crane

- ★ Read the Operation and Maintenance Manual of the crane carefully in advance and operate the crane safely.

6. Precautions for using overhead hoist crane

⚠ When raising a heavy part (heavier than 25 kg), use a hoist, etc. In Disassembly and assembly, the weight of a part heavier than 25 kg is indicated after the mark of .

- 1) Before starting work, inspect the wire ropes, brake, clutch, controller, rails, over wind stop device, electric shock prevention earth leakage breaker, crane collision prevention device, and power application warning lamp, and check safety.
- 2) Observe the signs for sling work.
- 3) Operate the hoist at a safe place.
- 4) Check the direction indicator plates (east, west, south, and north) and the directions of the control buttons without fail.
- 5) Do not sling a load slantingly. Do not move the crane while the slung load is swinging.
- 6) Do not raise or lower a load while the crane is moving longitudinally or laterally.
- 7) Do not drag a sling.
- 8) When lifting up a load, stop it just after it leaves the ground and check safety, and then lift it up.
- 9) Consider the travel route in advance and lift up a load to a safe height.
- 10) Place the control switch on a position where it will not be an obstacle to work and passage.
- 11) After operating the hoist, do not swing the control switch.
- 12) Remember the position of the main switch so that you can turn off the power immediately in an emergency.

- 13) If the hoist stops because of a power failure, turn the power switch OFF. When turning on a switch which was turned OFF by the electric shock prevention earth leakage breaker, check that the devices related to that switch are not in operation state.
- 14) If you find an obstacle around the hoist, stop the operation.
- 15) After finishing the work, stop the hoist at the specified position and raise the hook to at least 2 m above the floor. Do not leave the sling installed to the hook.

7. Selecting wire ropes

- 1) Select adequate ropes depending on the weight of parts to be hoisted, referring to the table below.

Wire ropes
(Standard "Z" twist ropes without galvanizing)
(JIS G3525, No. 6, Type 6X37-A)

Nominal diameter of rope mm	Allowable load	
	kN	ton
10	8.8	0.9
12	12.7	1.3
14	17.3	1.7
16	22.6	2.3
18	28.6	2.9
20	35.3	3.6
25	55.3	5.6
30	79.6	8.1
40	141.6	14.4
50	221.6	22.6
60	318.3	32.4

- ★ The allowable load is one-sixth of the breaking strength of the rope used (Safety coefficient: 6).

8. Precautions for disconnecting and connecting hoses and tubes in air conditioner circuit

1) Disconnection

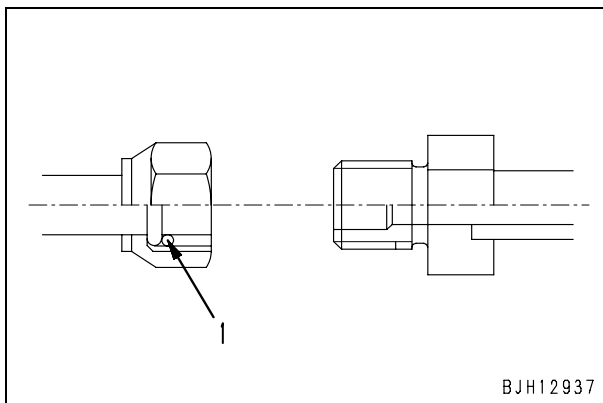
⚠ **Collect the air conditioner refrigerant gas (R134a).**

⚠ **If the refrigerant gas (R134a) gets in your eyes, you may lose your sight. Accordingly, when collecting or adding it, you must be qualified for handling the refrigerant and put on protective goggles.**

2) Connection

- 1] When installing the air conditioner circuit hoses and tubes, take care that dirt, dust, water, etc. will not enter them.
- 2] When connecting the air conditioner hoses and tubes, check that O-rings (1) are fitted to their joints.
- 3] Check that each O-ring is not damaged or deteriorated.
- 4] When connecting the refrigerant piping, apply compressor oil for refrigerant (R134a) (**DENSO: ND-OIL8, ZEXEL: ZXL100PG (equivalent to PAG46)**) to its O-rings.

★ Example of O-ring (Fitted to every joint of hoses and tubes)



★ For tightening torque, see the precautions for installation in each section of "Disassembly and assembly".

How to read the shop manual

- Some attachments and optional parts in this shop manual may not be delivered to certain areas. If one of them is required, consult KOMATSU distributors.
- Materials and specifications are subject to change without notice.
- Shop manuals are divided into the “Chassis volume” and “Engine volume”. For the engine unit, see the engine volume of the engine model mounted on the machine.

1. Composition of shop manual

This shop manual contains the necessary technical information for services performed in a workshop. For ease of understanding, the manual is divided into the following sections.

00. Index and foreword

This section explains the shop manuals list, table of contents, safety, and basic information.

01. Specification

This section explains the specifications of the machine.

10. Structure, function and maintenance standard

This section explains the structure, function, and maintenance standard values of each component. The structure and function sub-section explains the structure and function of each component. It serves not only to give an understanding of the structure, but also serves as reference material for troubleshooting. The maintenance standard sub-section explains the criteria and remedies for disassembly and service.

20. Standard value table

This section explains the standard values for new machine and judgement criteria for testing, adjusting, and troubleshooting. This standard value table is used to check the standard values in testing and adjusting and to judge parts in troubleshooting.

30. Testing and adjusting

This section explains measuring instruments and measuring methods for testing and adjusting, and method of adjusting each part. The standard values and judgement criteria for testing and adjusting are explained in Testing and adjusting.

40. Troubleshooting

This section explains how to find out failed parts and how to repair them. The troubleshooting is divided by failure modes. The “S mode” of the troubleshooting related to the engine may be also explained in the Chassis volume and Engine volume. In this case, see the Chassis volume.

50. Disassembly and assembly

This section explains the special tools and procedures for removing, installing, disassembling, and assembling each component, as well as precautions for them. In addition, tightening torque and quantity and weight of coating material, oil, grease, and coolant necessary for the work are also explained.

90. Diagrams and drawings (chassis volume)/Repair and replacement of parts (engine volume)

- Chassis volume
This section gives hydraulic circuit diagrams and electrical circuit diagrams.
- Engine volume
This section explains the method of reproducing, repairing, and replacing parts.

2. Revision and distribution

Any additions, revisions, or other change of notices will be sent to KOMATSU distributors. Get the most up-to-date information before you start any work.

3. Filing method

File by the brochures in the correct order of the form number printed in the shop manual composition table.

- **Revised edition mark**








When a manual is revised, the ones and tens digits of the form number of each brochure is increased by 1. (Example: 00, 01, 02 ...)

- **Revisions**

Revised brochures are shown in the shop manual composition table.

4. Symbols

Important safety and quality portions are marked with the following symbols so that the shop manual will be used practically.

Symbol	Item	Remarks
	Safety	Special safety precautions are necessary when performing work.
	Caution	Special technical precautions or other precautions for preserving standards are necessary when performing work.
	Weight	Weight of parts of component or parts. Caution necessary when selecting hoisting wire, or when working posture is important, etc.
	Tightening torque	Places that require special attention for tightening torque during assembly.
	Coat	Places to be coated with adhesives, etc. during assembly.
	Oil, coolant	Places where oil, etc. must be added, and capacity.
	Drain	Places where oil, etc. must be drained, and quantity to be drained.

5. Units

In this shop manual, the units are indicated with International System of units (SI). For reference, conventionally used Gravitational System of units is indicated in parentheses { }.

Explanation of terms for maintenance standard

The maintenance standard values necessary for judgment of products and parts are described by the following terms.

1. Standard size and tolerance

- To be accurate, the finishing size of parts is a little different from one to another.
- To specify a finishing size of a part, a temporary standard size is set and an allowable difference from that size is indicated.
- The above size set temporarily is called the “standard size” and the range of difference from the standard size is called the “tolerance”.
- The tolerance with the symbols of + or – is indicated on the right side of the standard size.

Example:

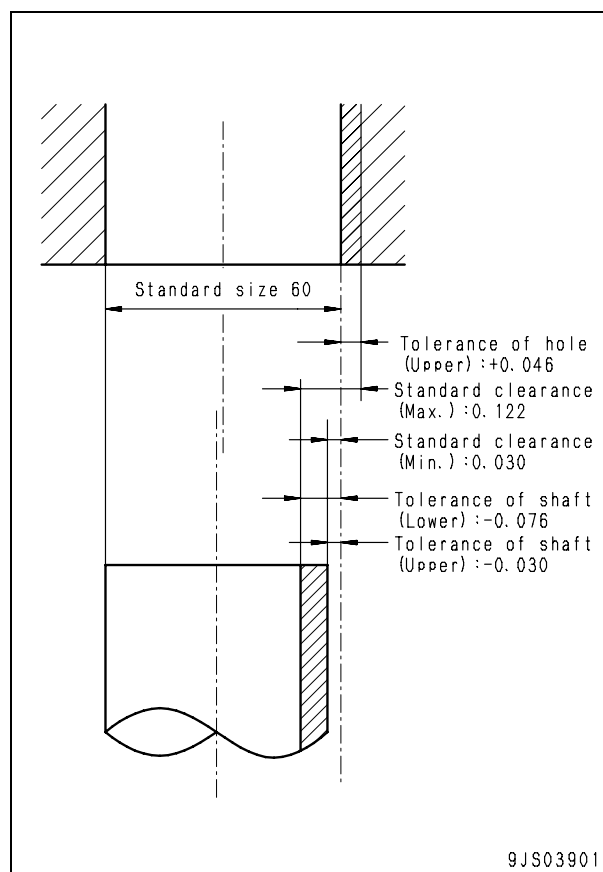
Standard size	Tolerance
120	–0.022 –0.126

- ★ The tolerance may be indicated in the text and a table as [standard size (upper limit of tolerance/lower limit of tolerance)].
Example) 120 (–0.022/–0.126)

- Usually, the size of a hole and the size of the shaft to be fitted to that hole are indicated by the same standard size and different tolerances of the hole and shaft. The tightness of fit is decided by the tolerance.
- Indication of size of rotating shaft and hole and relationship drawing of them

Example:

Standard size	Tolerance	
	Shaft	Hole
60	–0.030	+0.046
	–0.076	0



2. Standard clearance and standard value

- The clearance made when new parts are assembled is called the “standard clearance”, which is indicated by the range from the minimum clearance to the maximum clearance.
- When some parts are repaired, the clearance is generally adjusted to the standard clearance.
- A value of performance and function of new products or equivalent is called the “standard value”, which is indicated by a range or a target value.
- When some parts are repaired, the value of performance/function is set to the standard value.

3. Standard interference

- When the diameter of a hole of a part shown in the given standard size and tolerance table is smaller than that of the mating shaft, the difference between those diameters is called the “interference”.
- The range (A – B) from the difference (A) between the minimum size of the shaft and the maximum size of the hole to the difference (B) between the maximum size of the shaft and the minimum size of the hole is the “standard interference”.
- After repairing or replacing some parts, measure the size of their hole and shaft and check that the interference is in the standard range.

4. Repair limit and allowable value

- The size of a part changes because of wear and deformation while it is used. The limit of changed size is called the “repair limit”.
- If a part is worn to the repair limit must be replaced or repaired.
- The performance and function of a product lowers while it is used. A value below which the product can be used without causing a problem is called the “allowable value”.
- If a product is worn to the allowable value, it must be checked or repaired. Since the permissible value is estimated from various tests or experiences in most cases, however, it must be judged after considering the operating condition and customer's requirement.

5. Clearance limit

- Parts can be used until the clearance between them is increased to a certain limit. The limit at which those parts cannot be used is called the “clearance limit”.
- If the clearance between the parts exceeds the clearance limit, they must be replaced or repaired.

6. Interference limit

- The allowable maximum interference between the hole of a part and the shaft of another part to be assembled is called the “interference limit”.
- The interference limit shows the repair limit of the part of smaller tolerance.
- If the interference between the parts exceeds the interference limit, they must be replaced or repaired.

Handling electric equipment and hydraulic component

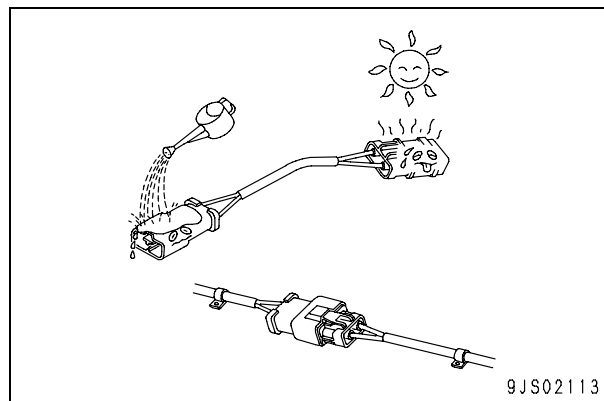
To maintain the performance of the machine over a long period, and to prevent failures or other troubles before they occur, correct “operation”, “maintenance and inspection”, “troubleshooting”, and “repairs” must be carried out. This section deals particularly with correct repair procedures for mechatronics and is aimed at improving the quality of repairs. For this purpose, it gives sections on “Handling electric equipment” and “Handling hydraulic equipment” (particularly gear oil and hydraulic oil).

Points to remember when handling electric equipment

1. Handling wiring harnesses and connectors

Wiring harnesses consist of wiring connecting one component to another component, connectors used for connecting and disconnecting one wire from another wire, and protectors or tubes used for protecting the wiring.

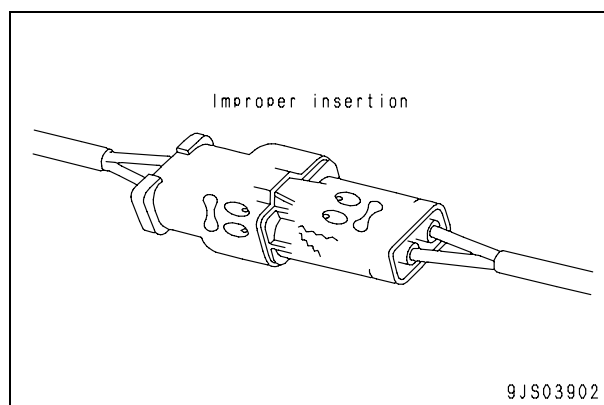
Compared with other electrical components fitted in boxes or cases, wiring harnesses are more likely to be affected by the direct effects of rain, water, heat, or vibration. Furthermore, during inspection and repair operations, they are frequently removed and installed again, so they are likely to suffer deformation or damage. For this reason, it is necessary to be extremely careful when handling wiring harnesses.



2. Main failures occurring in wiring harness

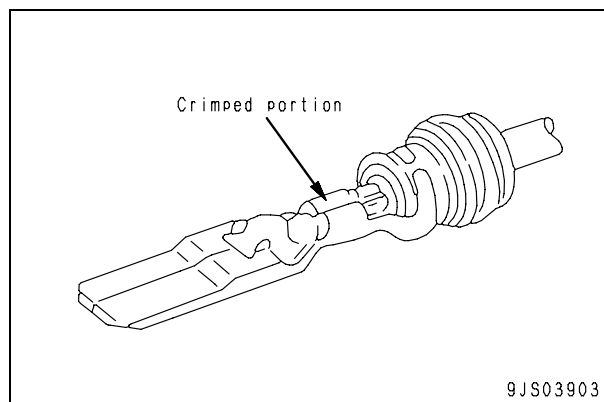
1) Defective contact of connectors (defective contact between male and female)

Problems with defective contact are likely to occur because the male connector is not properly inserted into the female connector, or because one or both of the connectors is deformed or the position is not correctly aligned, or because there is corrosion or oxidization of the contact surfaces. The corroded or oxidized contact surfaces may become shiny again (and contact may become normal) by connecting and disconnecting the connector about 10 times.



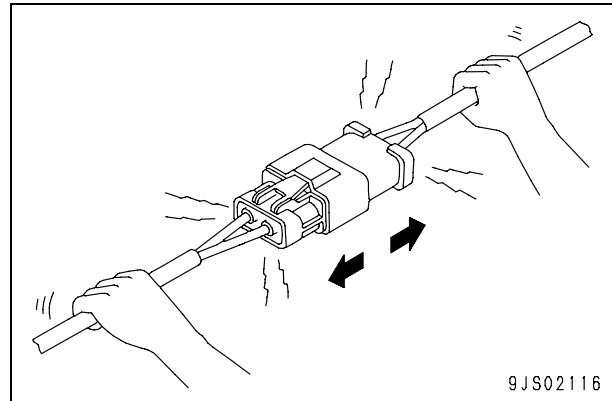
2) Defective crimping or soldering of connectors

The pins of the male and female connectors are in contact at the crimped terminal or soldered portion, but if there is excessive force brought to bear on the wiring, the plating at the joint will peel and cause improper connection or breakage.



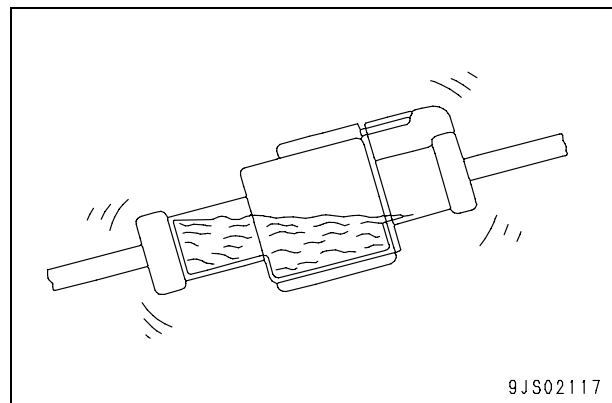
3) Disconnections in wiring

If the wiring is held and the connectors are pulled apart, or components are lifted with a crane with the wiring still connected, or a heavy object hits the wiring, the crimping of the connector may separate, or the soldering may be damaged, or the wiring may be broken.



4) High-pressure water entering connector

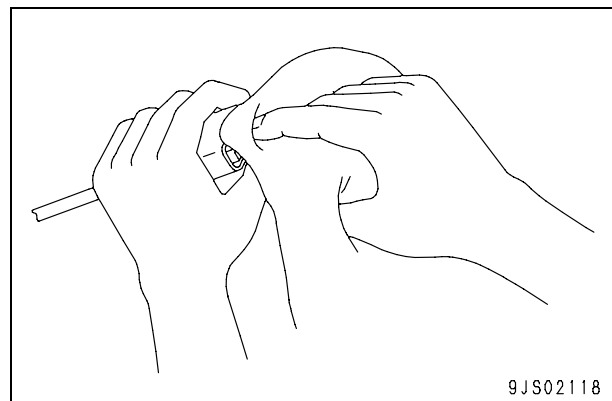
The connector is designed to make it difficult for water to enter (drip-proof structure), but if high-pressure water is sprayed directly on the connector, water may enter the connector, depending on the direction of the water jet. Accordingly, take care not to splash water over the connector. The connector is designed to prevent water from entering, but at the same time, if water does enter, it is difficult for it to be drained. Therefore, if water should get into the connector, the pins will be short-circuited by the water, so if any water gets in, immediately dry the connector or take other appropriate action before passing electricity through it.



5) Oil or dirt stuck to connector

If oil or grease are stuck to the connector and an oil film is formed on the mating surface between the male and female pins, the oil will not let the electricity pass, so there will be defective contact. If there is oil or grease stuck to the connector, wipe it off with a dry cloth or blow it dry with compressed air and spray it with a contact restorer.

- ★ When wiping the mating portion of the connector, be careful not to use excessive force or deform the pins.
- ★ If there is oil or water in the compressed air, the contacts will become even dirtier, so remove the oil and water from the compressed air completely before cleaning with compressed air.



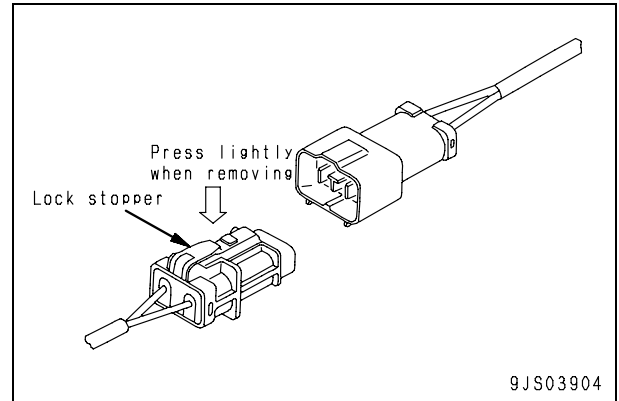
3. Removing, installing, and drying connectors and wiring harnesses

1) Disconnecting connectors

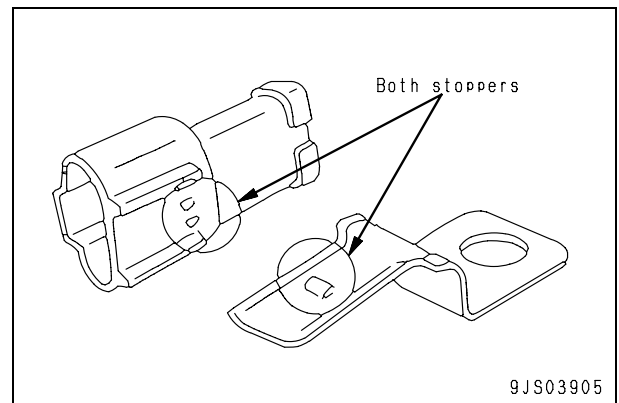
- 1] Hold the connectors when disconnecting.

When disconnecting the connectors, hold the connectors. For connectors held by a screw, loosen the screw fully, then hold the male and female connectors in each hand and pull apart. For connectors which have a lock stopper, press down the stopper with your thumb and pull the connectors apart.

★ Never pull with one hand.

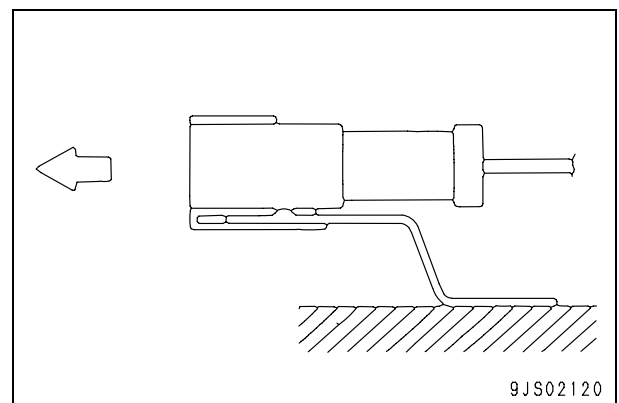


- 2] When removing from clips
 - Both of the connector and clip have stoppers, which are engaged with each other when the connector is installed.



- When removing a connector from a clip, pull the connector in a parallel direction to the clip for removing stoppers.

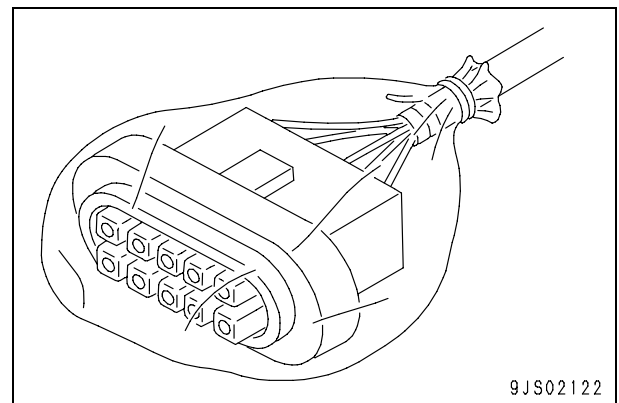
★ If the connector is twisted up and down or to the left or right, the housing may break.



- 3] Action to take after removing connectors

After removing any connector, cover it with a vinyl bag to prevent any dust, dirt, oil, or water from getting in the connector portion.

★ If the machine is left disassembled for a long time, it is particularly easy for improper contact to occur, so always cover the connector.



2) Connecting connectors

1] Check the connector visually.

Check that there is no oil, dirt, or water stuck to the connector pins (mating portion).

Check that there is no deformation, defective contact, corrosion, or damage to the connector pins.

Check that there is no damage or breakage to the outside of the connector.

★ If there is any oil, water, or dirt stuck to the connector, wipe it off with a dry cloth. If any water has got inside the connector, warm the inside of the wiring with a dryer, but be careful not to make it too hot as this will cause short circuits.

★ If there is any damage or breakage, replace the connector.

2] Fix the connector securely.

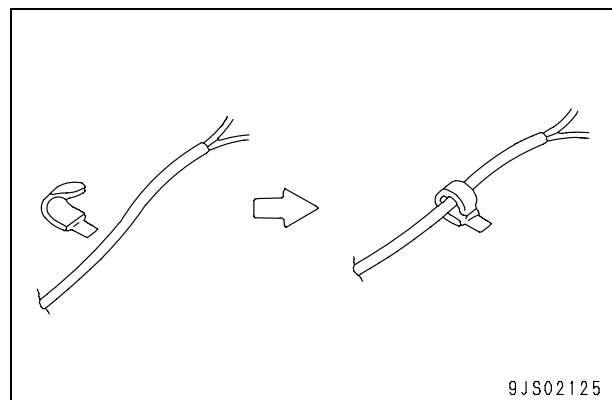
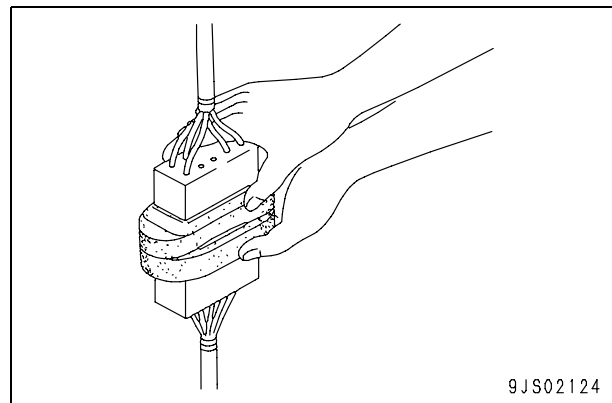
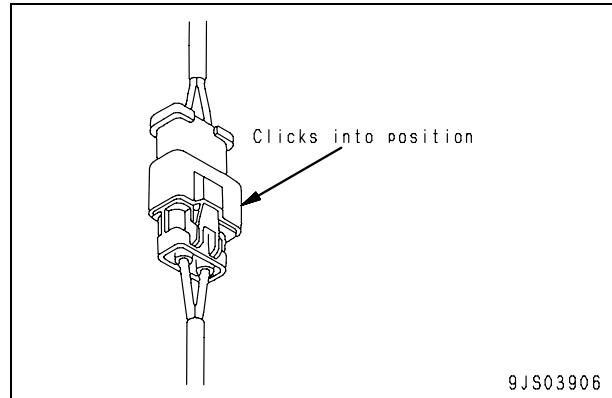
Align the position of the connector correctly, and then insert it securely. For connectors with the lock stopper, push in the connector until the stopper clicks into position.

3] Correct any protrusion of the boot and any misalignment of the wiring harness.

For connectors fitted with boots, correct any protrusion of the boot. In addition, if the wiring harness is misaligned, or the clamp is out of position, adjust it to its correct position.

★ If the connector cannot be corrected easily, remove the clamp and adjust the position.

● If the connector clamp has been removed, be sure to return it to its original position. Check also that there are no loose clamps.



- 3) Heavy duty wire connector (DT 8-pole, 12-pole)

Disconnection (Left of figure)

While pressing both sides of locks (a) and (b), pull out female connector (2).

Connection (Right of figure)

- 1] Push in female connector (2) horizontally until the lock clicks.

Arrow: 1)

- 2] Since locks (a) and (b) may not be set completely, push in female connector (2) while moving it up and down until the locks are set normally.

Arrow: 1), 2), 3)

★ Right of figure: Lock (a) is pulled down (not set completely) and lock (b) is set completely.

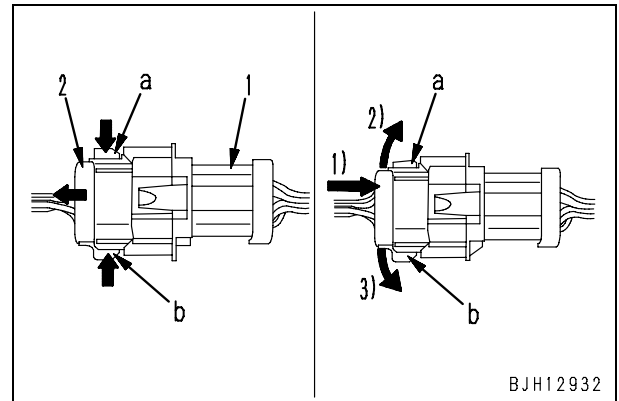
(1): Male connector

(2): Female connector

(a), (b): Locks

• Disconnection

• Connection (Example of incomplete setting of (a))



4) Drying wiring harness

If there is any oil or dirt on the wiring harness, wipe it off with a dry cloth. Avoid washing it in water or using steam. If the connector must be washed in water, do not use high-pressure water or steam directly on the wiring harness. If water gets directly on the connector, do as follows.

- 1] Disconnect the connector and wipe off the water with a dry cloth.

★ If the connector is blown dry with compressed air, there is the risk that oil in the air may cause defective contact, so remove all oil and water from the compressed air before blowing with air.

- 2] Dry the inside of the connector with a dryer.

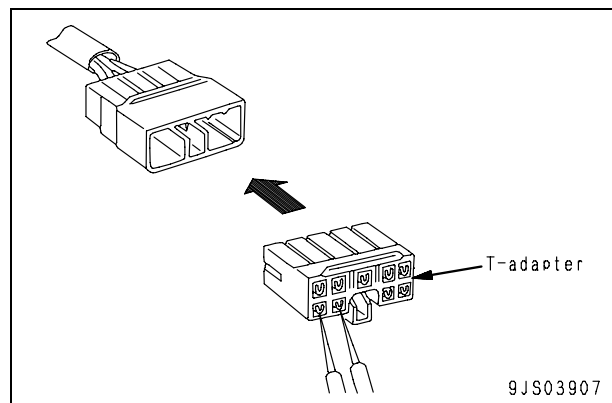
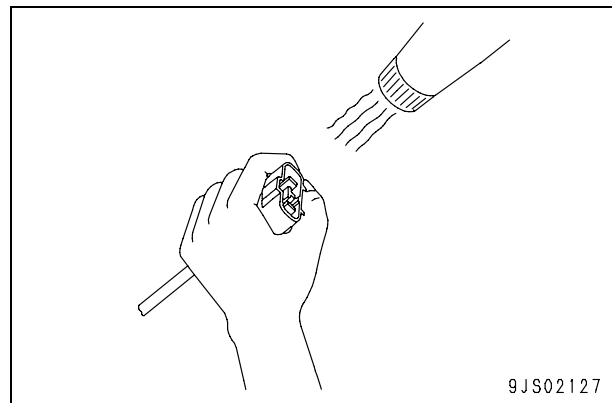
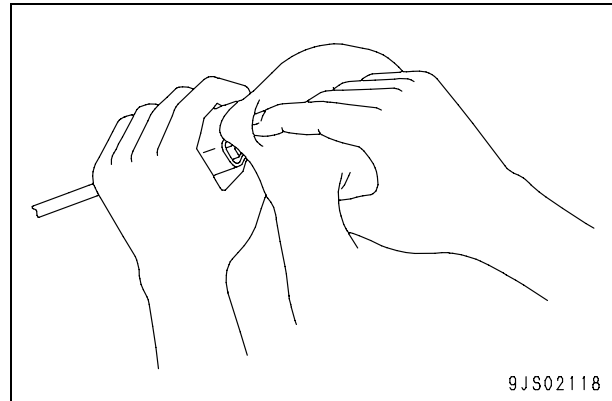
If water gets inside the connector, use a dryer to dry the connector.

★ Hot air from the dryer can be used, but regulate the time that the hot air is used in order not to make the connector or related parts too hot, as this will cause deformation or damage to the connector.

- 3] Carry out a continuity test on the connector.

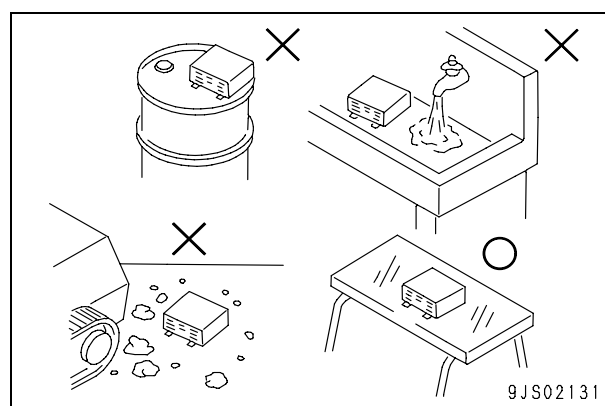
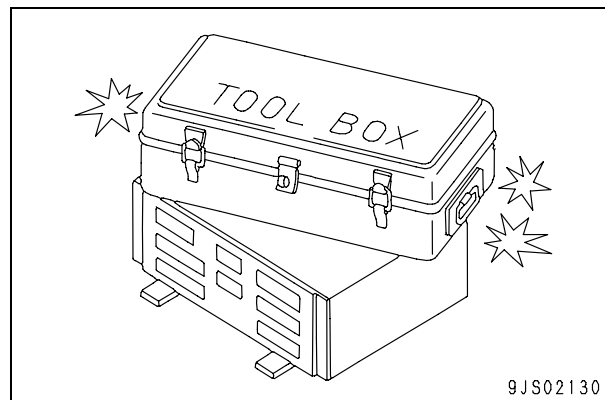
After drying, leave the wiring harness disconnected and carry out a continuity test to check for any short circuits between pins caused by water.

★ After completely drying the connector, blow it with contact restorer and reassemble.



4. Handling controller

- 1) The controller contains a microcomputer and electronic control circuits. These control all of the electronic circuits on the machine, so be extremely careful when handling the controller.
- 2) Do not place objects on top of the controller.
- 3) Cover the control connectors with tape or a vinyl bag. Never touch the connector contacts with your hand.
- 4) During rainy weather, do not leave the controller in a place where it is exposed to rain.
- 5) Do not place the controller on oil, water, or soil, or in any hot place, even for a short time. (Place it on a suitable dry stand).
- 6) Precautions when carrying out arc welding
When carrying out arc welding on the body, disconnect all wiring harness connectors connected to the controller. Fit an arc welding ground close to the welding point.



5. Points to remember when troubleshooting electric circuits

- 1) Always turn the power OFF before disconnecting or connecting connectors.
- 2) Before carrying out troubleshooting, check that all the related connectors are properly inserted.
 - ★ Disconnect and connect the related connectors several times to check.
- 3) Always connect any disconnected connectors before going on to the next step.
 - ★ If the power is turned ON with the connectors still disconnected, unnecessary abnormality displays will be generated.
- 4) When carrying out troubleshooting of circuits (measuring the voltage, resistance, continuity, or current), move the related wiring and connectors several times and check that there is no change in the reading of the tester.
 - ★ If there is any change, there is probably defective contact in that circuit.

Points to remember when handling hydraulic equipment

With the increase in pressure and precision of hydraulic equipment, the most common cause of failure is dirt (foreign material) in the hydraulic circuit. When adding hydraulic oil, or when disassembling or assembling hydraulic equipment, it is necessary to be particularly careful.

1. Be careful of the operating environment.

Avoid adding hydraulic oil, replacing filters, or repairing the machine in rain or high winds, or places where there is a lot of dust.

2. Disassembly and maintenance work in the field

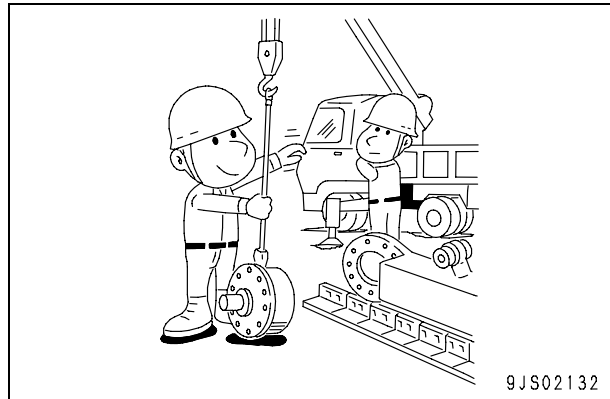
If disassembly or maintenance work is carried out on hydraulic equipment in the field, there is danger of dust entering the equipment. It is also difficult to check the performance after repairs, so it is desirable to use unit exchange. Disassembly and maintenance of hydraulic equipment should be carried out in a specially prepared dustproof workshop, and the performance should be checked with special test equipment.

3. Sealing openings

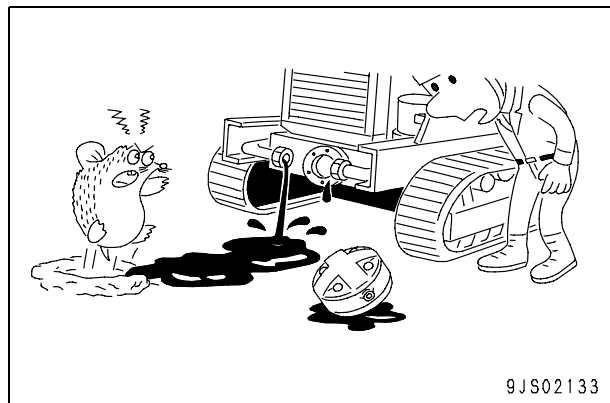
After any piping or equipment is removed, the openings should be sealed with caps, tapes, or vinyl bags to prevent any dirt or dust from entering. If the opening is left open or is blocked with a rag, there is danger of dirt entering or of the surrounding area being made dirty by leaking oil so never do this. Do not simply drain oil out onto the ground, but collect it and ask the customer to dispose of it, or take it back with you for disposal.

4. Do not let any dirt or dust get in during refilling operations

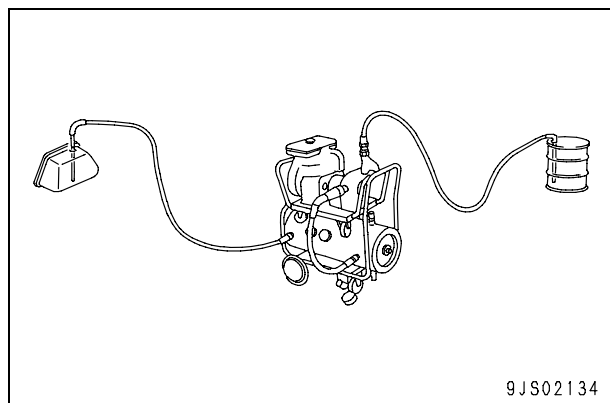
Be careful not to let any dirt or dust get in when refilling with hydraulic oil. Always keep the oil filler and the area around it clean, and also use clean pumps and oil containers. If an oil cleaning device is used, it is possible to filter out the dirt that has collected during storage, so this is an even more effective method.



9JS02132



9JS02133



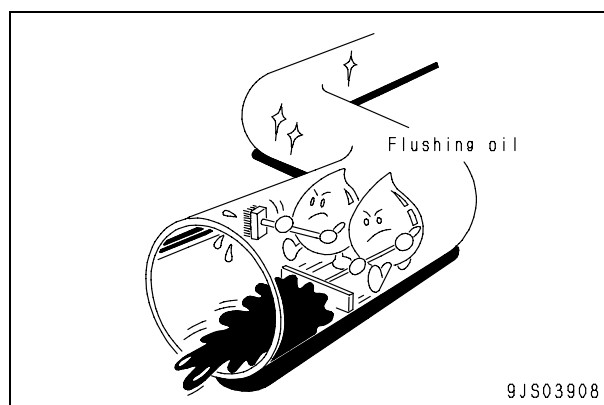
9JS02134

5. Change hydraulic oil when the temperature is high

When hydraulic oil or other oil is warm, it flows easily. In addition, the sludge can also be drained out easily from the circuit together with the oil, so it is best to change the oil when it is still warm. When changing the oil, as much as possible of the old hydraulic oil must be drained out. (Drain the oil from the hydraulic tank; also drain the oil from the filter and from the drain plug in the circuit.) If any old oil is left, the contaminants and sludge in it will mix with the new oil and will shorten the life of the hydraulic oil.

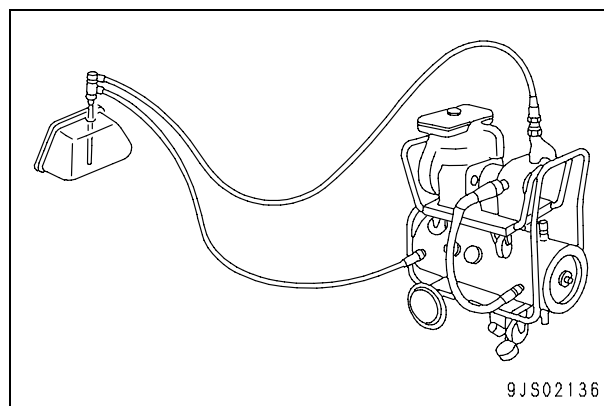
6. Flushing operations

After disassembling and assembling the equipment, or changing the oil, use flushing oil to remove the contaminants, sludge, and old oil from the hydraulic circuit. Normally, flushing is carried out twice: primary flushing is carried out with flushing oil, and secondary flushing is carried out with the specified hydraulic oil.



7. Cleaning operations

After repairing the hydraulic equipment (pump, control valve, etc.) or when running the machine, carry out oil cleaning to remove the sludge or contaminants in the hydraulic oil circuit. The oil cleaning equipment is used to remove the ultra fine (about 3 μ) particles that the filter built in the hydraulic equipment cannot remove, so it is an extremely effective device.



Connectors newly used for Tier 3 engines

1. Slide lock type

(FRAMATOME-3, FRAMATOME-2)

- 107 – 170, 12V140 engines
 - Various pressure sensors and NE speed sensor

Examples)

Intake air pressure in intake manifold:

PIM (125, 170, 12V140 engines)

Oil pressure sensor: POIL
(125, 170, 12V140 engines)

Oil pressure switch
(107, 114 engines)

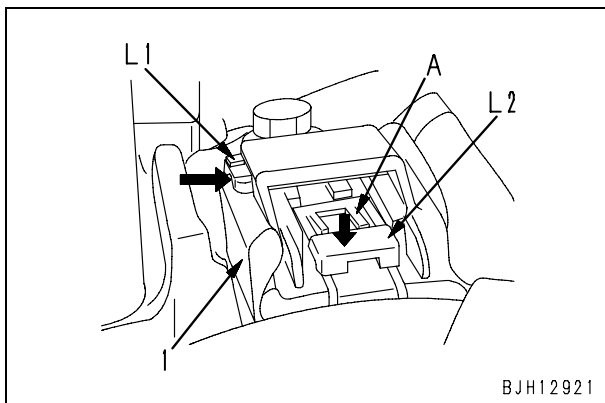
Ne speed sensor of flywheel housing:
NE (107 – 170, 12V140 engines)

Ambient pressure sensor: PAMB
(125, 170, 12V140 engines)

Disconnect connector (1) according to the following procedure.

- 1) Slide lock (L1) to the right.
- 2) While pressing lock (L2), pull out connector (1) toward you.

- ★ Even if lock (L2) is pressed, connector (1) cannot be pulled out toward you, if part A does not float. In this case, float part A with a small screwdriver while press lock (L2), and then pull out connector (1) toward you.



2. Pull lock type (PACKARD-2)

- 107 – 170, 12V140 engine
 - Various temperature sensors

Example)

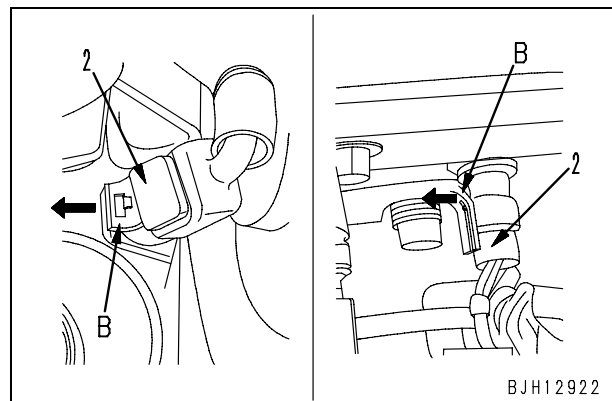
Intake air temperature sensor in intake manifold: TIM

Fuel temperature sensor: TFUEL

Oil temperature sensor: TOIL

Coolant temperature sensor: TWTR, etc.

Disconnect the connector by pulling lock (B) (on the wiring harness side) of connector (2) outward.



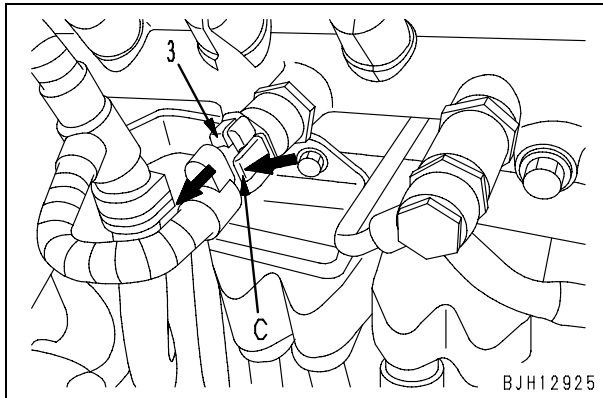
3. Push lock type

- 107, 114 engines
Example)
Fuel pressure sensor in common rail
(**BOSCH-03**)

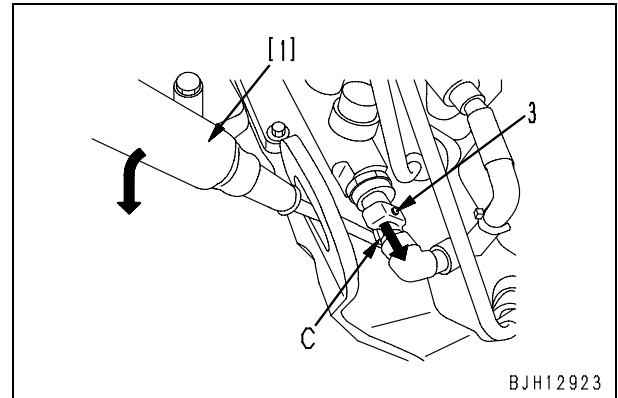
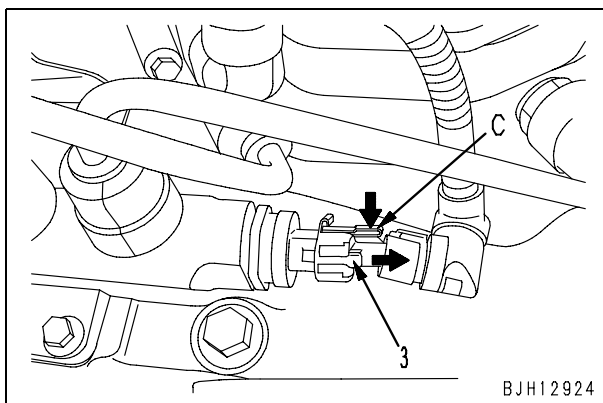
Disconnect connector (3) according to the following procedure.

- 1) While pressing lock (C), pull out connector (3) in the direction of the arrow.

- 114 engine

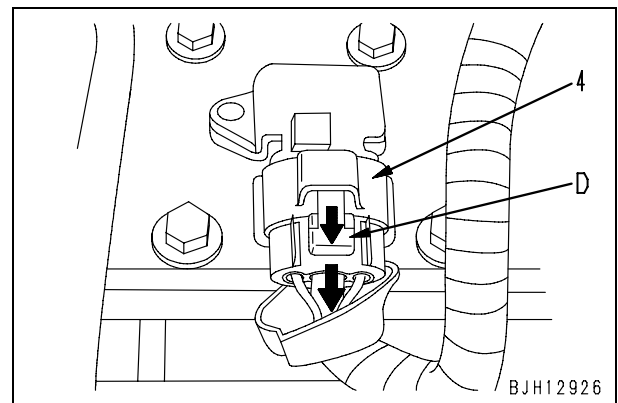


- 107 engine



- 107, 114 engine
Example)
Intake air pressure/temperature sensor in
intake manifold
(**SUMITOMO-04**)

- 3) While pressing lock (D), pull out connector (4) in the direction of the arrow.



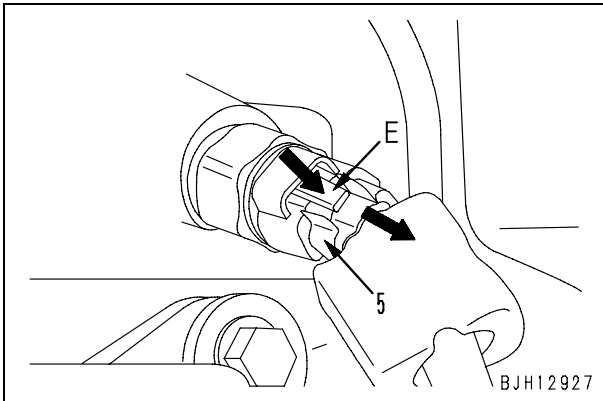
★ If the lock is on the underside, use flat-head screwdriver [1] since you cannot insert your fingers.

- 2) While pressing up lock (C) of the connector with flat-head screwdriver [1], pull out connector (3) in the direction of the arrow.

- 125 – 170, 12V140 engine
- 4) While pressing lock (E) of the connector, pull out connector (5) in the direction of the arrow.

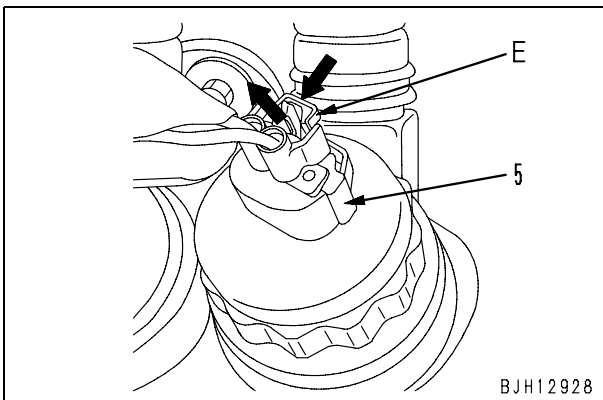
Example)

Fuel pressure in common rail: PFUEL etc.
(AMP-3)



Example)

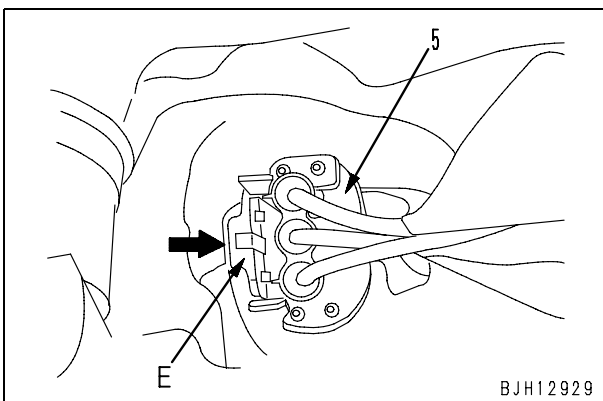
Injection pressure control valve of fuel supply pump: PCV (SUMITOMO-2)



Example)

Speed sensor of fuel supply pump: G (SUMITOMO-3)

- ★ Pull the connector straight up.



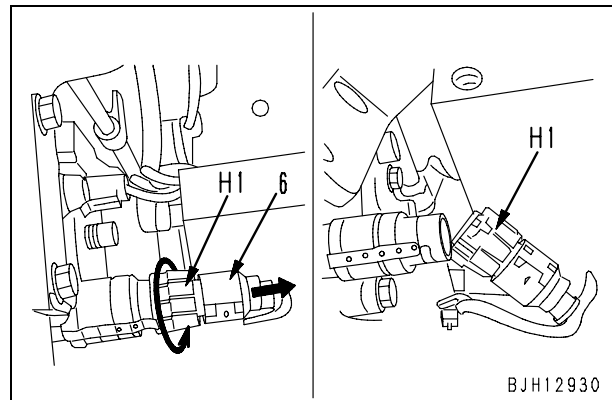
4. Turn-housing type (Round green connector)

- 140 engine

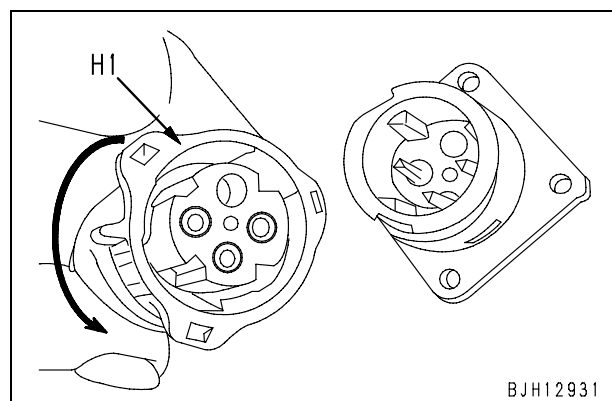
Example)

Intake air pressure sensor in intake manifold (CANNON-04): PIM etc.

- 1) Disconnect connector (6) according to the following procedure.
 - 1] Turn housing (H1) in the direction of the arrow.
 - ★ When connector is unlocked, housing (H1) becomes heavy to turn.
 - 2] Pull out housing (H1) in the direction of the arrow.
 - ★ Housing (H1) is left on the wiring harness side.



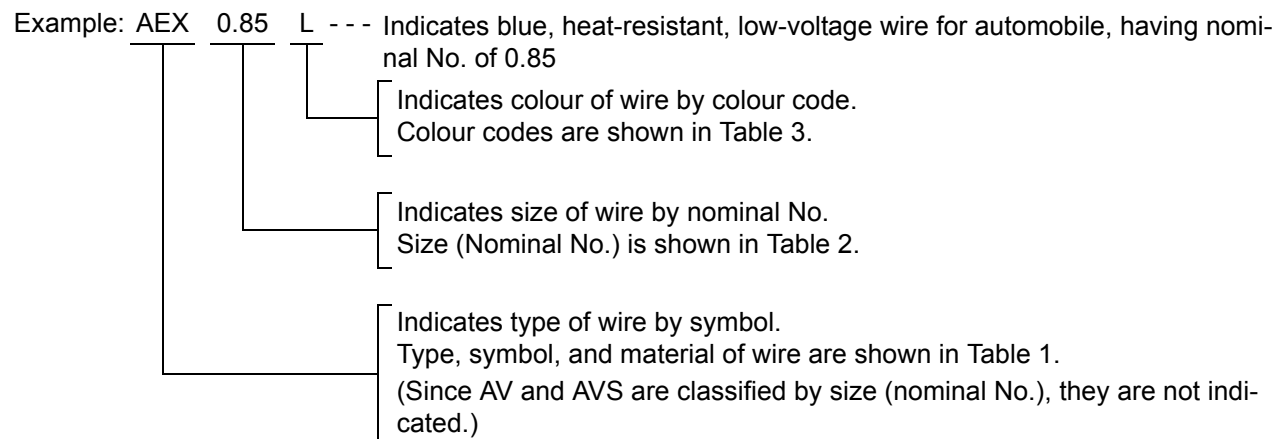
- 2) Connect the connector according to the following procedure.
 - 1] Insert the connector to the end, while setting its groove.
 - 2] Turn housing (H1) in the direction of the arrow until it "clicks".



How to read electric wire code

- ★ The information about the wires unique to each machine model is described in Troubleshooting section, Relational information of troubleshooting.

In the electric circuit diagram, the material, thickness, and colour of each electric wire are indicated by symbols. The electric wire code is helpful in understanding the electric circuit diagram.



1. Type, symbol, and material

AV and AVS are different in only thickness and outside diameter of the cover. AEX is similar to AV in thickness and outside diameter of AEX and different from AV and AVS in material of the cover.

(Table 1)

Type	Sym- bol	Material		Using temperature range (°C)	Example of use
Low-voltage wire for automobile	AV	Conduc- tor	Annealed copper for elec- tric appliance	-30 to +60	General wiring (Nominal No. 5 and above)
		Insulator	Soft polyvinyl chloride		
Thin-cover low-voltage wire for automobile	AVS	Conduc- tor	Annealed copper for elec- tric appliance		General wiring (Nominal No. 3 and below)
		Insulator	Soft polyvinyl chloride		
Heat-resist- ant low-volt- age wire for automobile	AEX	Conduc- tor	Annealed copper for elec- tric appliance	-50 to +110	General wiring in extremely cold district, wiring at high-tem- perature place
		Insulator	Heat-resistant crosslinked polyethylene		

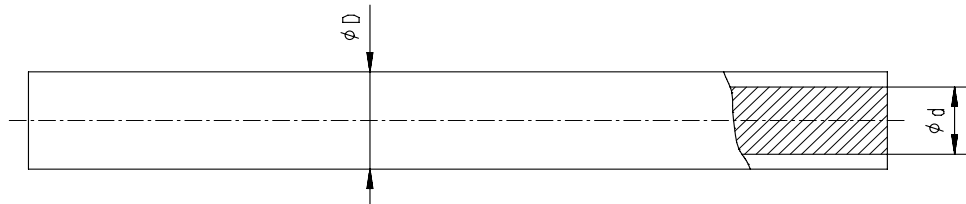
2. Dimensions

(Table 2)

Nominal No.		0.5f	(0.5)	0.75f	(0.85)	1.25f	(1.25)	2f	2	3f	3	5
Conductor	Number of strands/Diameter of strand	20/0.18	7/0.32	30/0.18	11/0.32	50/0.18	16/0.32	37/0.26	26/0.32	58/0.26	41/0.32	65/0.32
	Sectional area (mm ²)	0.51	0.56	0.76	0.88	1.27	1.29	1.96	2.09	3.08	3.30	5.23
	d (approx.)	1.0		1.2		1.5		1.9	1.9	2.3	2.4	3.0
Cover D	AVS Standard	2.0		2.2		2.5		2.9	2.9	3.5	3.6	—
	AV Standard	—		—		—		—	—	—	—	4.6
	AEX Standard	2.0		2.2		2.7		3.0	3.1	—	3.8	4.6

Nominal No.		8	15	20	30	40	50	60	85	100
Conductor	Number of strands/Diameter of strand	50/0.45	84/0.45	41/0.80	70/0.80	85/0.80	108/0.80	127/0.80	169/0.80	217/0.80
	Sectional area (mm ²)	7.95	13.36	20.61	35.19	42.73	54.29	63.84	84.96	109.1
	d (approx.)	3.7	4.8	6.0	8.0	8.6	9.8	10.4	12.0	13.6
Cover D	AVS Standard	—	—	—	—	—	—	—	—	—
	AV Standard	5.5	7.0	8.2	10.8	11.4	13.0	13.6	16.0	17.6
	AEX Standard	5.3	7.0	8.2	10.8	11.4	13.0	13.6	16.0	17.6

“f” of nominal No. denotes flexible”.



9JS02064

3. Colour codes table

(Table 3)

Colour Code	Colour of wire	Colour Code	Colour of wire
B	Black	LgW	Light green & White
Br	Brown	LgY	Light green & Yellow
BrB	Brown & Black	LR	Blue & Red
BrR	Brown & Red	LW	Blue & White
BrW	Brown & White	LY	Blue & Yellow
BrY	Brown & Yellow	O	Orange
Ch	Charcoal	P	Pink
Dg	Dark green	R	Red
G	Green	RB	Red & Black
GB	Green & Black	RG	Red & Green
GL	Green & Blue	RL	Red & Blue
Gr	Gray	RW	Red & White
GR	Green & Red	RY	Red & Yellow
GW	Green & White	Sb	Sky Blue
GY	Green & Yellow	Y	Yellow
L	Blue	YB	Yellow & Black
LB	Blue & Black	YG	Yellow & Green
Lg	Light green	YL	Yellow & Blue
LgB	Light green & Black	YR	Yellow & Red
LgR	Light green & Red	YW	Yellow & White

Remarks: In a colour code consisting of 2 colours, the first colour is the colour of the background and the second colour is the colour of the marking.

Example: "GW" means that the background is Green and marking is White.

4. Types of circuits and colour codes

(Table 4)

Type of wire		AVS or AV						AEX	
Type of circuit	Charge	R	WG	–	–	–	–	R	–
	Ground	B	–	–	–	–	–	B	–
	Start	R	–	–	–	–	–	R	–
	Light	RW	RB	RY	RG	RL	–	D	–
	Instrument	Y	YR	YB	YG	YL	YW	Y	Gr
	Signal	G	GW	GR	GY	GB	GL	G	Br
	Others	L	LW	LR	LY	LB	–	L	–
		Br	BrW	BrR	BrY	BrB	–	–	–
		Lg	LgR	LgY	LgB	LgW	–	–	–
		O	–	–	–	–	–	–	–
		Gr	–	–	–	–	–	–	–
		P	–	–	–	–	–	–	–
		Sb	–	–	–	–	–	–	–
		Dg	–	–	–	–	–	–	–
		Ch	–	–	–	–	–	–	–

Precautions when carrying out operation

[When carrying out removal or installation (disassembly or assembly) of units, be sure to follow the general precautions given below when carrying out the operation.]

1. Precautions when carrying out removal work

- If the coolant contains antifreeze, dispose of it correctly.
- After disconnecting hoses or tubes, cover them or fit plugs to prevent dirt or dust from entering.
- When draining oil, prepare a container of adequate size to catch the oil.
- Confirm the match marks showing the installation position, and make match marks in the necessary places before removal to prevent any mistake when assembling.
- To prevent any excessive force from being applied to the wiring, always hold the connectors when disconnecting the connectors. Do not pull the wires.
- Fit wires and hoses with tags to show their installation position to prevent any mistake when installing.
- Check the number and thickness of the shims, and keep in a safe place.
- When raising components, be sure to use lifting equipment of ample strength.
- When using forcing screws to remove any components, tighten the forcing screws uniformly in turn.
- Before removing any unit, clean the surrounding area and fit a cover to prevent any dust or dirt from entering after removal.

★ Precautions when handling piping during disassembly

Fit the following plugs into the piping after disconnecting it during disassembly operations.

1) Face seal type hoses and tubes

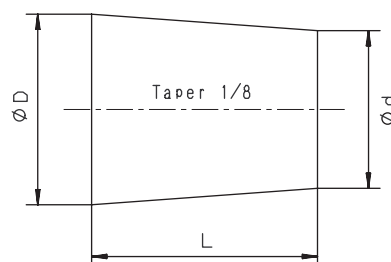
Nominal number	Plug (nut end)	Sleeve nut (elbow end)
02	07376-70210	02789-20210
03	07376-70315	02789-20315
04	07376-70422	02789-20422
05	07376-70522	02789-20522
06	07376-70628	02789-20628
10	07376-71034	07221-21034
12	07376-71234	07221-21234

2) Split flange type hoses and tubes

Nominal number	Flange (hose end)	Sleeve head (tube end)	Split flange
04	07379-00400	07378-10400	07371-30400
05	07379-00500	07378-10500	07371-30500

3) If the part is not under hydraulic pressure, the following corks can be used.

Nominal number	Part Number	Dimensions		
		D	d	L
06	07049-00608	6	5	8
08	07049-00811	8	6.5	11
10	07049-01012	10	8.5	12
12	07049-01215	12	10	15
14	07049-01418	14	11.5	18
16	07049-01620	16	13.5	20
18	07049-01822	18	15	22
20	07049-02025	20	17	25
22	07049-02228	22	18.5	28
24	07049-02430	24	20	30
27	07049-02734	27	22.5	34



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2. Precautions when carrying out installation work

- Tighten all bolts and nuts (sleeve nuts) to the specified (KES) torque.
 - Install the hoses without twisting or interference and fix them with intermediate clamps, if there are any.
 - Replace all gaskets, O-rings, cotter pins, and lock plates with new parts.
 - Bend the cotter pins and lock plates securely.
 - When coating with adhesive, clean the part and remove all oil and grease, then coat the threaded portion with 2 – 3 drops of adhesive.
 - When coating with gasket sealant, clean the surface and remove all oil and grease, check that there is no dirt or damage, then coat uniformly with gasket sealant.
 - Clean all parts, and correct any damage, dents, burrs, or rust.
 - Coat rotating parts and sliding parts with engine oil.
 - When press fitting parts, coat the surface with anti-friction compound (LM-P).
 - After fitting snap rings, check that the snap ring is fitted securely in the ring groove.
 - When connecting wiring connectors, clean the connector to remove all oil, dirt, or water, then connect securely.
 - When using eyebolts, check that there is no deformation or deterioration, screw them in fully, and align the direction of the hook.
 - When tightening split flanges, tighten uniformly in turn to prevent excessive tightening on one side.
- ★ When operating the hydraulic cylinders for the first time after reassembling cylinders, pumps and other hydraulic equipment removed for repair, always bleed the air as follows:
- 1) Start the engine and run at low idle.
 - 2) Operate the work equipment control lever to operate the hydraulic cylinder 4 – 5 times, stopping the cylinder 100 mm from the end of its stroke.
 - 3) Next, operate the hydraulic cylinder 3 – 4 times to the end of its stroke.
 - 4) After doing this, run the engine at normal speed.
- ★ When using the machine for the first time after repair or long storage, follow the same procedure.

3. Precautions when completing the operation

- 1) Refilling with coolant, oil and grease
 - If the coolant has been drained, tighten the drain valve, and add coolant to the specified level. Run the engine to circulate the coolant through the system. Then check the coolant level again.
 - If the hydraulic equipment has been removed and installed again, add engine oil to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.
 - If the piping or hydraulic equipment have been removed, always bleed the air from the system after reassembling the parts.
 - ★ For details, see Testing and adjusting, “Bleeding air”.
 - Add the specified amount of grease (molybdenum disulphide grease) to the work equipment parts.
- 2) Checking cylinder head and manifolds for looseness

Check the cylinder head and intake and exhaust manifold for looseness.
If any part is loosened, re tighten it.

 - For the tightening torque, see “Disassembly and assembly”.
- 3) Checking engine piping for damage and looseness

Intake and exhaust system

Check the piping for damage, the mounting bolts and nuts for looseness, and the joints for air suction and exhaust gas leakage.
If any part is loosened or damaged, re tighten or repair it.

Cooling system

Check the piping for damage, the mounting bolts and nuts for looseness, and the joints for coolant leakage.
If any part is loosened or damaged, re tighten or repair it.

Fuel system

Check the piping for damage, the mounting bolts and nuts for looseness, and the joints for fuel leakage.
If any part is loosened or damaged, re tighten or repair it.

- 4) Checking muffler and exhaust pipe for damage and looseness
 - 1] Visually check the muffler, exhaust pipe and their mounting parts for a crack and damage.
If any part is damaged, replace it.
 - 2] Check the mounting bolts and nuts of the muffler, exhaust pipe and their mounting parts for looseness.
If any bolt or nut is loosened, re tighten it.
- 5) Checking muffler function
Check the muffler for abnormal sound and sound different from that of a new muffler.
If any abnormal sound is heard, repair the muffler, referring to "Troubleshooting" and "Disassembly and assembly".

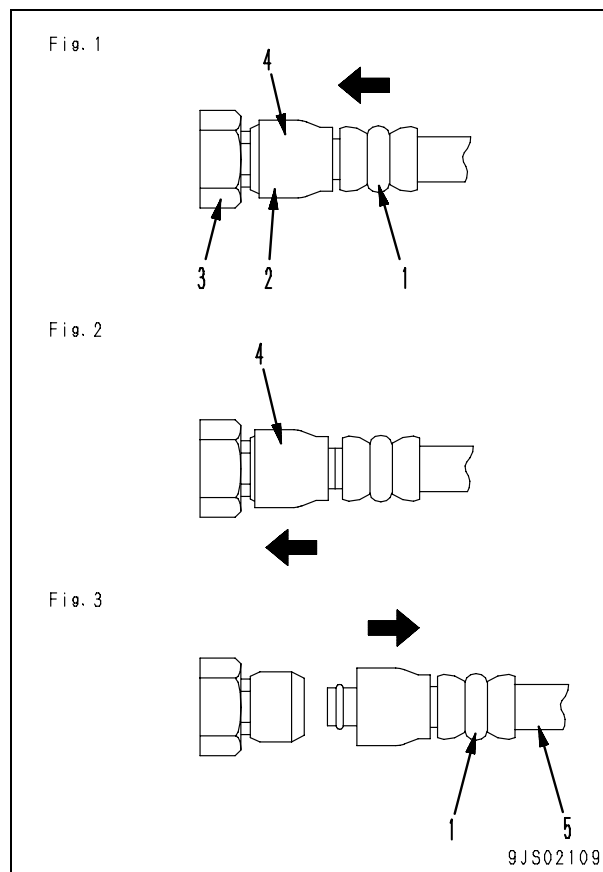
Method of disassembling and connecting push-pull type coupler

- ⚠ Before carrying out the following work, loosen the oil filler cap of the hydraulic tank gradually to release the residual pressure from the hydraulic tank.
- ⚠ Even if the residual pressure is released from the hydraulic tank, some hydraulic oil flows out when the hose is disconnected. Accordingly, prepare an oil receiving container.

Type 1

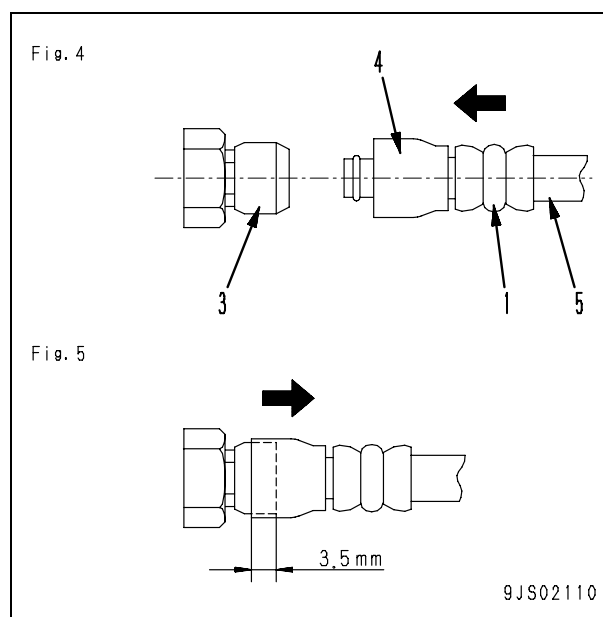
1. Disconnection

- 1) Hold adapter (1) and push hose joint (2) into mating adapter (3). (Fig. 1)
 - ★ The adapter can be pushed in about 3.5 mm.
 - ★ Do not hold rubber cap portion (4).
- 2) After hose joint (2) is pushed into adapter (3), press rubber cap portion (4) against adapter (3) until it clicks. (Fig. 2)
- 3) Hold hose adapter (1) or hose (5) and pull it out. (Fig. 3)
 - ★ Since some hydraulic oil flows out, prepare an oil receiving container.



2. Connection

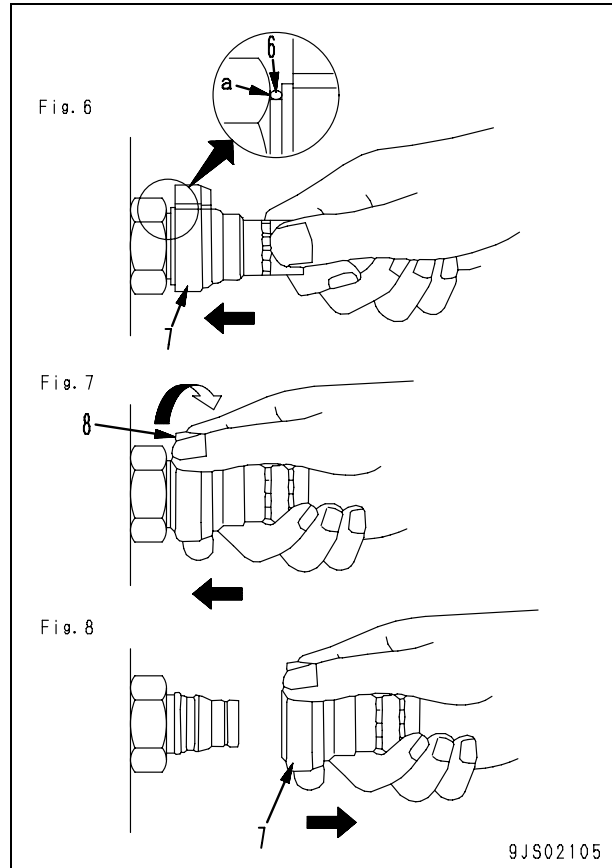
- 1) Hold hose adapter (1) or hose (5) and insert it in mating adapter (3), aligning them with each other. (Fig. 4)
 - ★ Do not hold rubber cap portion (4).
- 2) After inserting the hose in the mating adapter perfectly, pull it back to check its connecting condition. (Fig. 5)
 - ★ When the hose is pulled back, the rubber cap portion moves toward the hose about 3.5 mm. This does not indicate abnormality, however.



Type 2

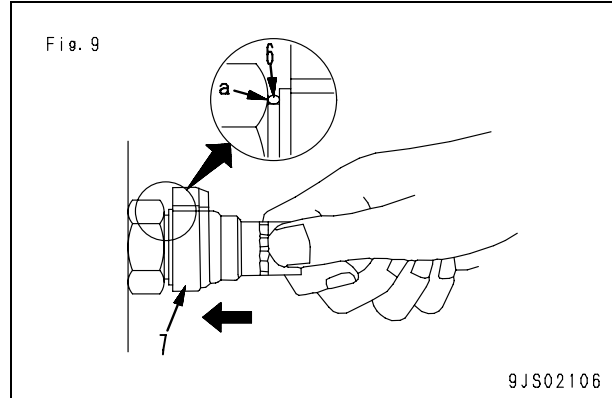
1. Disconnection

- 1) Hold the tightening portion and push body (7) straight until sliding prevention ring (6) contacts contact surface (a) of the hexagonal portion at the male end. (Fig. 6)
- 2) While holding the condition of Step 1), turn lever (8) to the right (clockwise). (Fig. 7)
- 3) While holding the condition of Steps 1) and 2), pull out whole body (7) to disconnect it. (Fig. 8)



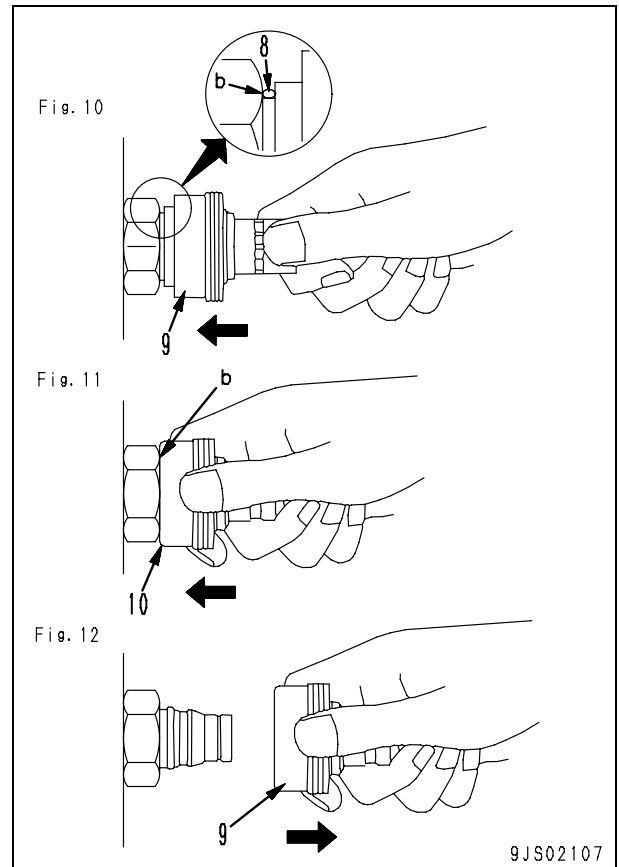
2. Connection

- Hold the tightening portion and push body (7) straight until sliding prevention ring (6) contacts contact surface (a) of the hexagonal portion at the male end. (Fig. 9)

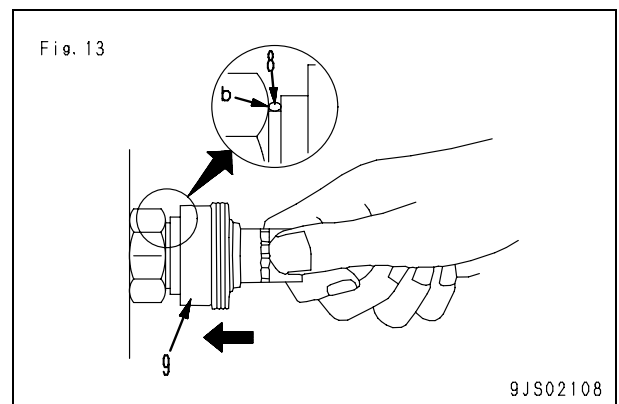


Type 3**1. Disconnection**

- 1) Hold the tightening portion and push body (9) straight until sliding prevention ring (8) contacts contact surface (b) of the hexagonal portion at the male end. (Fig. 10)
- 2) While holding the condition of Step 1), push cover (10) straight until it contacts contact surface (b) of the hexagonal portion at the male end. (Fig. 11)
- 3) While holding the condition of Steps 1) and 2), pull out whole body (9) to disconnect it. (Fig. 12)

**2. Connection**

- Hold the tightening portion and push body (9) straight until the sliding prevention ring contacts contact surface (b) of the hexagonal portion at the male end. (Fig. 13)



Standard tightening torque table

1. Table of tightening torques for bolts and nuts

★ Unless there are special instructions, tighten metric nuts and bolts to the torque below. (When using torque wrench)

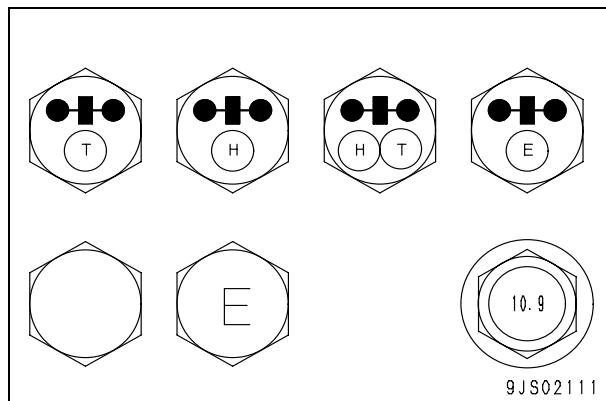
★ The following table corresponds to the bolts in Fig. A.

Thread diameter of bolt mm	Width across flats mm	Tightening torque	
		Nm	kgm
6	10	11.8 – 14.7	1.2 – 1.5
8	13	27 – 34	2.8 – 3.5
10	17	59 – 74	6.0 – 7.5
12	19	98 – 123	10.0 – 12.5
14	22	153 – 190	15.5 – 19.5
16	24	235 – 285	23.5 – 29.5
18	27	320 – 400	33.0 – 41.0
20	30	455 – 565	46.5 – 58.0
22	32	610 – 765	62.5 – 78.0
24	36	785 – 980	80.0 – 100.0
27	41	1,150 – 1,440	118 – 147
30	46	1,520 – 1,910	155 – 195
33	50	1,960 – 2,450	200 – 250
36	55	2,450 – 3,040	250 – 310
39	60	2,890 – 3,630	295 – 370

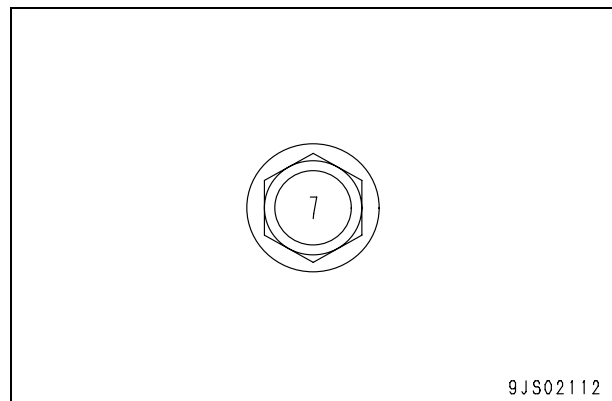
★ The following table corresponds to the bolts in Fig. B.

Thread diameter of bolt mm	Width across flats mm	Tightening torque	
		Nm	kgm
6	10	5.9 – 9.8	0.6 – 1.0
8	13	13.7 – 23.5	1.4 – 2.4
10	14	34.3 – 46.1	3.5 – 4.7
12	27	74.5 – 90.2	7.6 – 9.2

★ Fig. A



★ Fig. B



2. Table of tightening torques for split flange bolts

★ Unless there are special instructions, tighten split flange bolts to the torque below.

Thread diameter of bolt	Width across flats	Tightening torque	
mm	mm	Nm	kgm
10	14	59 – 74	6.0 – 7.5
12	17	98 – 123	10.0 – 12.5
16	22	235 – 285	23.5 – 29.5

3. Table of tightening torques for O-ring boss piping joints

★ Unless there are special instructions, tighten O-ring boss piping joints to the torque below.

Nominal No.	Thread diameter	Width across flats	Tightening torque Nm {kgm}	
	mm	mm	Range	Target
02	14	Varies depending on type of connector.	35 – 63 { 3.5 – 6.5 }	44 { 4.5 }
03,04	20		84 – 132 { 8.5 – 13.5 }	103 { 10.5 }
05,06	24		128 – 186 { 13.0 – 19.0 }	157 { 16.0 }
10,12	33		363 – 480 { 37.0 – 49.0 }	422 { 43.0 }
14	42		746 – 1,010 { 76.0 – 103 }	883 { 90.0 }

4. Table of tightening torques for O-ring boss plugs

★ Unless there are special instructions, tighten O-ring boss plugs to the torque below.

Nominal No.	Thread diameter	Width across flats	Tightening torque Nm {kgm}	
	mm	mm	Range	Target
08	8	14	5.88 – 8.82 { 0.6 – 0.9 }	7.35 { 0.75 }
10	10	17	9.81 – 12.74 { 1.0 – 1.3 }	11.27 { 1.15 }
12	12	19	14.7 – 19.6 { 1.5 – 2.0 }	17.64 { 1.8 }
14	14	22	19.6 – 24.5 { 2.0 – 2.5 }	22.54 { 2.3 }
16	16	24	24.5 – 34.3 { 2.5 – 3.5 }	29.4 { 3.0 }
18	18	27	34.3 – 44.1 { 3.5 – 4.5 }	39.2 { 4.0 }
20	20	30	44.1 – 53.9 { 4.5 – 5.5 }	49.0 { 5.0 }
24	24	32	58.8 – 78.4 { 6.0 – 8.0 }	68.6 { 7.0 }
30	30	32	93.1 – 122.5 { 9.5 – 12.5 }	107.8 { 11.0 }
33	33	–	107.8 – 147.0 { 11.0 – 15.0 }	127.4 { 13.0 }
36	36	36	127.4 – 176.4 { 13.0 – 18.0 }	151.9 { 15.5 }
42	42	–	181.3 – 240.1 { 18.5 – 24.5 }	210.7 { 21.5 }
52	52	–	274.4 – 367.5 { 28.0 – 37.5 }	323.4 { 33.0 }

5. Table of tightening torques for hoses (taper seal type and face seal type)

- ★ Unless there are special instructions, tighten the hoses (taper seal type and face seal type) to the torque below.
- ★ Apply the following torque when the threads are coated (wet) with engine oil.

Nominal No. of hose	Width across flats	Tightening torque Nm {kgm}		Taper seal Thread size (mm)	Face seal	
		Range	Target		Nominal No. - Number of threads, type of thread	Thread diameter (mm) (Reference)
02	19	34 – 54 { 3.5 – 5.5 }	44 { 4.5 }	–	9/16-18UN	14.3
		34 – 63 { 3.5 – 6.5 }		14	–	–
03	22	54 – 93 { 5.5 – 9.5 }	74 { 7.5 }	–	11/16-16UN	17.5
	24	59 – 98 { 6.0 – 10.0 }	78 { 8.0 }	18	–	–
04	27	84 – 132 { 8.5 – 13.5 }	103 { 10.5 }	22	13/16-16UN	20.6
05	32	128 – 186 { 13.0 – 19.0 }	157 { 16.0 }	24	1-14UNS	25.4
06	36	177 – 245 { 18.0 – 25.0 }	216 { 22.0 }	30	1-3/16-12UN	30.2
(10)	41	177 – 245 { 18.0 – 25.0 }	216 { 22.0 }	33	–	–
(12)	46	197 – 294 { 20.0 – 30.0 }	245 { 25.0 }	36	–	–
(14)	55	246 – 343 { 25.0 – 35.0 }	294 { 30.0 }	42	–	–

6. Table of tightening torques for 102, 107 and 114 engine series (Bolts and nuts)

- ★ Unless there are special instructions, tighten the metric bolts and nuts of the 102, 107 and 114 engine series to the torque below.

Thread size	Tightening torque	
	Bolts and nuts	
mm	Nm	kgm
6	10 ± 2	1.02 ± 0.20
8	24 ± 4	2.45 ± 0.41
10	43 ± 6	4.38 ± 0.61
12	77 ± 12	7.85 ± 1.22
14	—	—

7. Table of tightening torques for 102, 107 and 114 engine series (Eye joints)

- ★ Unless there are special instructions, tighten the metric eye joints of the 102, 107 and 114 engine series to the torque below.

Thread size	Tightening torque	
	Nm	kgm
6	8 ± 2	0.81 ± 0.20
8	10 ± 2	1.02 ± 0.20
10	12 ± 2	1.22 ± 0.20
12	24 ± 4	2.45 ± 0.41
14	36 ± 5	3.67 ± 0.51

8. Table of tightening torques for 102, 107 and 114 engine series (Taper screws)

- ★ Unless there are special instructions, tighten the taper screws (unit: inch) of the 102, 107 and 114 engine series to the torque below.

Thread size	Tightening torque	
	Nm	kgm
1/16	3 ± 1	0.31 ± 0.10
1/8	8 ± 2	0.81 ± 0.20
1/4	12 ± 2	1.22 ± 0.20
3/8	15 ± 2	1.53 ± 0.20
1/2	24 ± 4	2.45 ± 0.41
3/4	36 ± 5	3.67 ± 0.51
1	60 ± 9	6.12 ± 0.92

Conversion table

Method of using the conversion table

The conversion table in this section is provided to enable simple conversion of figures. For details of the method of using the conversion table, see the example given below.

Example: Method of using the conversion table to convert from millimetres to inches

1. Convert 55 mm into inches.

- 1) Locate the number 50 in the vertical column at the left side, take this as (A), and then draw a horizontal line from (A).
- 2) Locate the number 5 in the row across the top, take this as (B), then draw a perpendicular line down from (B).
- 3) Take the point where the 2 lines cross as (C). This point (C) gives the value when converting from millimetres to inches. Therefore, 55 mm = 2.165 inches.

2. Convert 550 mm into inches.

- 1) The number 550 does not appear in the table, so divide it by 10 (move the decimal point one place to the left) to convert it to 55 mm.
- 2) Carry out the same procedure as above to convert 55 mm to 2.165 inches.
- 3) The original value (550 mm) was divided by 10, so multiply 2.165 inches by 10 (move the decimal point one place to the right) to return to the original value. This gives 550 mm = 21.65 inches.

Millimetres to inches

(B)

1 mm = 0.03937 in

	0	1	2	3	4	5	6	7	8	9
0	0	0.039	0.079	0.118	0.157	0.197	0.236	0.276	0.315	0.354
10	0.394	0.433	0.472	0.512	0.551	0.591	0.630	0.669	0.709	0.748
20	0.787	0.827	0.866	0.906	0.945	0.984	1.024	1.063	1.102	1.142
30	1.181	1.220	1.260	1.299	1.339	1.378	1.417	1.457	1.496	1.536
40	1.575	1.614	1.654	1.693	1.732	1.772	1.811	1.850	1.890	1.929
(A) 50	1.969	2.008	2.047	2.087	2.126	2.165	2.205	2.244	2.283	2.323
60	2.362	2.402	2.441	2.480	2.520	2.559	2.598	2.638	2.677	2.717
70	2.756	2.795	2.835	2.874	2.913	2.953	2.992	3.032	3.071	3.110
80	3.150	3.189	3.228	3.268	3.307	3.346	3.386	3.425	3.465	3.504
90	3.543	3.583	3.622	3.661	3.701	3.740	3.780	3.819	3.858	3.898

Millimetres to inches

1 mm = 0.03937 in

	0	1	2	3	4	5	6	7	8	9
0	0	0.039	0.079	0.118	0.157	0.197	0.236	0.276	0.315	0.354
10	0.394	0.433	0.472	0.512	0.551	0.591	0.630	0.669	0.709	0.748
20	0.787	0.827	0.866	0.906	0.945	0.984	1.024	1.063	1.102	1.142
30	1.181	1.220	1.260	1.299	1.339	1.378	1.417	1.457	1.496	1.536
40	1.575	1.614	1.654	1.693	1.732	1.772	1.811	1.850	1.890	1.929
50	1.969	2.008	2.047	2.087	2.126	2.165	2.205	2.244	2.283	2.323
60	2.362	2.402	2.441	2.480	2.520	2.559	2.598	2.638	2.677	2.717
70	2.756	2.795	2.835	2.874	2.913	2.953	2.992	3.032	3.071	3.110
80	3.150	3.189	3.228	3.268	3.307	3.346	3.386	3.425	3.465	3.504
90	3.543	3.583	3.622	3.661	3.701	3.740	3.780	3.819	3.858	3.898

Kilogram to pound

1 kg = 2.2046 lb

	0	1	2	3	4	5	6	7	8	9
0	0	2.20	4.41	6.61	8.82	11.02	13.23	15.43	17.64	19.84
10	22.05	24.25	26.46	28.66	30.86	33.07	35.27	37.48	39.68	41.89
20	44.09	46.30	48.50	50.71	51.91	55.12	57.32	59.53	61.73	63.93
30	66.14	68.34	70.55	72.75	74.96	77.16	79.37	81.57	83.78	85.98
40	88.18	90.39	92.59	94.80	97.00	99.21	101.41	103.62	105.82	108.03
50	110.23	112.44	114.64	116.85	119.05	121.25	123.46	125.66	127.87	130.07
60	132.28	134.48	136.69	138.89	141.10	143.30	145.51	147.71	149.91	152.12
70	154.32	156.53	158.73	160.94	163.14	165.35	167.55	169.76	171.96	174.17
80	176.37	178.57	180.78	182.98	185.19	187.39	189.60	191.80	194.01	196.21
90	198.42	200.62	202.83	205.03	207.24	209.44	211.64	213.85	216.05	218.26

Litres to U.S. Gallons

1 ℓ = 0.2642 U.S.Gal

	0	1	2	3	4	5	6	7	8	9
0	0	0.264	0.528	0.793	1.057	1.321	1.585	1.849	2.113	2.378
10	2.642	2.906	3.170	3.434	3.698	3.963	4.227	4.491	4.755	5.019
20	5.283	5.548	5.812	6.076	6.340	6.604	6.869	7.133	7.397	7.661
30	7.925	8.189	8.454	8.718	8.982	9.246	9.510	9.774	10.039	10.303
40	10.567	10.831	11.095	11.359	11.624	11.888	12.152	12.416	12.680	12.944
50	13.209	13.473	13.737	14.001	14.265	14.529	14.795	15.058	15.322	15.586
60	15.850	16.115	16.379	16.643	16.907	17.171	17.435	17.700	17.964	18.228
70	18.492	18.756	19.020	19.285	19.549	19.813	20.077	20.341	20.605	20.870
80	21.134	21.398	21.662	21.926	22.190	22.455	22.719	22.983	23.247	23.511
90	23.775	24.040	24.304	24.568	24.832	25.096	25.361	25.625	25.889	26.153

Litres to U.K. Gallons

1 ℓ = 0.21997 U.K.Gal

	0	1	2	3	4	5	6	7	8	9
0	0	0.220	0.440	0.660	0.880	1.100	1.320	1.540	1.760	1.980
10	2.200	2.420	2.640	2.860	3.080	3.300	3.520	3.740	3.950	4.179
20	4.399	4.619	4.839	5.059	5.279	5.499	5.719	5.939	6.159	6.379
30	6.599	6.819	7.039	7.259	7.479	7.699	7.919	8.139	8.359	8.579
40	8.799	9.019	9.239	9.459	9.679	9.899	10.119	10.339	10.559	10.778
50	10.998	11.281	11.438	11.658	11.878	12.098	12.318	12.528	12.758	12.978
60	13.198	13.418	13.638	13.858	14.078	14.298	14.518	14.738	14.958	15.178
70	15.398	15.618	15.838	16.058	16.278	16.498	16.718	16.938	17.158	17.378
80	17.598	17.818	18.037	18.257	18.477	18.697	18.917	19.137	19.357	19.577
90	19.797	20.017	20.237	20.457	20.677	20.897	21.117	21.337	21.557	21.777

kgm to ft.lb

1 kgm = 7.233 ft.lb

	0	1	2	3	4	5	6	7	8	9
0	0	7.2	14.5	21.7	28.9	36.2	43.4	50.6	57.9	65.1
10	72.3	79.6	86.8	94.0	101.3	108.5	115.7	123.0	130.2	137.4
20	144.7	151.9	159.1	166.4	173.6	180.8	188.1	195.3	202.5	209.8
30	217.0	224.2	231.5	238.7	245.9	253.2	260.4	267.6	274.9	282.1
40	289.3	296.6	303.8	311.0	318.3	325.5	332.7	340.0	347.2	354.4
50	361.7	368.9	376.1	383.4	390.6	397.8	405.1	412.3	419.5	426.8
60	434.0	441.2	448.5	455.7	462.9	470.2	477.4	484.6	491.8	499.1
70	506.3	513.5	520.8	528.0	535.2	542.5	549.7	556.9	564.2	571.4
80	578.6	585.9	593.1	600.3	607.6	614.8	622.0	629.3	636.5	643.7
90	651.0	658.2	665.4	672.7	679.9	687.1	694.4	701.6	708.8	716.1
100	723.3	730.5	737.8	745.0	752.2	759.5	766.7	773.9	781.2	788.4
110	795.6	802.9	810.1	817.3	824.6	831.8	839.0	846.3	853.5	860.7
120	868.0	875.2	882.4	889.7	896.9	904.1	911.4	918.6	925.8	933.1
130	940.3	947.5	954.8	962.0	969.2	976.5	983.7	990.9	998.2	1005.4
140	1012.6	1019.9	1027.1	1034.3	1041.5	1048.8	1056.0	1063.2	1070.5	1077.7
150	1084.9	1092.2	1099.4	1106.6	1113.9	1121.1	1128.3	1135.6	1142.8	1150.0
160	1157.3	1164.5	1171.7	1179.0	1186.2	1193.4	1200.7	1207.9	1215.1	1222.4
170	1129.6	1236.8	1244.1	1251.3	1258.5	1265.8	1273.0	1280.1	1287.5	1294.7
180	1301.9	1309.2	1316.4	1323.6	1330.9	1338.1	1345.3	1352.6	1359.8	1367.0
190	1374.3	1381.5	1388.7	1396.0	1403.2	1410.4	1417.7	1424.9	1432.1	1439.4

kg/cm² to lb/in²1 kg/cm² = 14.2233 lb/in²

	0	1	2	3	4	5	6	7	8	9
0	0	14.2	28.4	42.7	56.9	71.1	85.3	99.6	113.8	128.0
10	142.2	156.5	170.7	184.9	199.1	213.4	227.6	241.8	256.0	270.2
20	284.5	298.7	312.9	327.1	341.4	355.6	369.8	384.0	398.3	412.5
30	426.7	440.9	455.1	469.4	483.6	497.8	512.0	526.3	540.5	554.7
40	568.9	583.2	597.4	611.6	625.8	640.1	654.3	668.5	682.7	696.9
50	711.2	725.4	739.6	753.8	768.1	782.3	796.5	810.7	825.0	839.2
60	853.4	867.6	881.8	896.1	910.3	924.5	938.7	953.0	967.2	981.4
70	995.6	1,010	1,024	1,038	1,053	1,067	1,081	1,095	1,109	1,124
80	1,138	1,152	1,166	1,181	1,195	1,209	1,223	1,237	1,252	1,266
90	1,280	1,294	1,309	1,323	1,337	1,351	1,365	1,380	1,394	1,408
100	1,422	1,437	1,451	1,465	1,479	1,493	1,508	1,522	1,536	1,550
110	1,565	1,579	1,593	1,607	1,621	1,636	1,650	1,664	1,678	1,693
120	1,707	1,721	1,735	1,749	1,764	1,778	1,792	1,806	1,821	1,835
130	1,849	1,863	1,877	1,892	1,906	1,920	1,934	1,949	1,963	1,977
140	1,991	2,005	2,020	2,034	2,048	2,062	2,077	2,091	2,105	2,119
150	2,134	2,148	2,162	2,176	2,190	2,205	2,219	2,233	2,247	2,262
160	2,276	2,290	2,304	2,318	2,333	2,347	2,361	2,375	2,389	2,404
170	2,418	2,432	2,446	2,460	2,475	2,489	2,503	2,518	2,532	2,546
180	2,560	2,574	2,589	2,603	2,617	2,631	2,646	2,660	2,674	2,688
190	2,702	2,717	2,731	2,745	2,759	2,773	2,788	2,802	2,816	2,830
200	2,845	2,859	2,873	2,887	2,901	2,916	2,930	2,944	2,958	2,973
210	2,987	3,001	3,015	3,030	3,044	3,058	3,072	3,086	3,101	3,115
220	3,129	3,143	3,158	3,172	3,186	3,200	3,214	3,229	3,243	3,257
230	3,271	3,286	3,300	3,314	3,328	3,343	3,357	3,371	3,385	3,399
240	3,414	3,428	3,442	3,456	3,470	3,485	3,499	3,513	3,527	3,542

Temperature

Fahrenheit-Centigrade conversion: A simple way to convert a Fahrenheit temperature reading into a Centigrade temperature reading or vice versa is to enter the accompanying table in the centre (boldface column) of figures. These figures refer to the temperature in either Fahrenheit or Centigrade degrees.

When convert from Fahrenheit to Centigrade degrees, consider the centre column to be a table of Fahrenheit temperatures and read the corresponding Centigrade temperature in the column at the left.

When convert from Centigrade to Fahrenheit degrees, consider the centre column to be a table of Centigrade values, and read the corresponding Fahrenheit temperature on the right.

1°C = 33.8°F

°C		°F	°C		°F	°C		°F	°C		°F
-40.4	-40	-40.0	-11.7	11	51.8	7.8	46	114.8	27.2	81	177.8
-37.2	-35	-31.0	-11.1	12	53.6	8.3	47	116.6	27.8	82	179.6
-34.4	-30	-22.0	-10.6	13	55.4	8.9	48	118.4	28.3	83	181.4
-31.7	-25	-13.0	-10.0	14	57.2	9.4	49	120.2	28.9	84	183.2
-28.9	-20	-4.0	-9.4	15	59.0	10.0	50	122.0	29.4	85	185.0
-28.3	-19	-2.2	-8.9	16	60.8	10.6	51	123.8	30.0	86	186.8
-27.8	-18	-0.4	-8.3	17	62.6	11.1	52	125.6	30.6	87	188.6
-27.2	-17	1.4	-7.8	18	64.4	11.7	53	127.4	31.1	88	190.4
-26.7	-16	3.2	-7.2	19	66.2	12.2	54	129.2	31.7	89	192.2
-26.1	-15	5.0	-6.7	20	68.0	12.8	55	131.0	32.2	90	194.0
-25.6	-14	6.8	-6.1	21	69.8	13.3	56	132.8	32.8	91	195.8
-25.0	-13	8.6	-5.6	22	71.6	13.9	57	134.6	33.3	92	197.6
-24.4	-12	10.4	-5.0	23	73.4	14.4	58	136.4	33.9	93	199.4
-23.9	-11	12.2	-4.4	24	75.2	15.0	59	138.2	34.4	94	201.2
-23.3	-10	14.0	-3.9	25	77.0	15.6	60	140.0	35.0	95	203.0
-22.8	-9	15.8	-3.3	26	78.8	16.1	61	141.8	35.6	96	204.8
-22.2	-8	17.6	-2.8	27	80.6	16.7	62	143.6	36.1	97	206.6
-21.7	-7	19.4	-2.2	28	82.4	17.2	63	145.4	36.7	98	208.4
-21.1	-6	21.2	-1.7	29	84.2	17.8	64	147.2	37.2	99	210.2
-20.6	-5	23.0	-1.1	30	86.0	18.3	65	149.0	37.8	100	212.0
-20.0	-4	24.8	-0.6	31	87.8	18.9	66	150.8	40.6	105	221.0
-19.4	-3	26.6	0	32	89.6	19.4	67	152.6	43.3	110	230.0
-18.9	-2	28.4	0.6	33	91.4	20.0	68	154.4	46.1	115	239.0
-18.3	-1	30.2	1.1	34	93.2	20.6	69	156.2	48.9	120	248.0
-17.8	0	32.0	1.7	35	95.0	21.1	70	158.0	51.7	125	257.0
-17.2	1	33.8	2.2	36	96.8	21.7	71	159.8	54.4	130	266.0
-16.7	2	35.6	2.8	37	98.6	22.2	72	161.6	57.2	135	275.0
-16.1	3	37.4	3.3	38	100.4	22.8	73	163.4	60.0	140	284.0
-15.6	4	39.2	3.9	39	102.2	23.3	74	165.2	62.7	145	293.0
-15.0	5	41.0	4.4	40	104.0	23.9	75	167.0	65.6	150	302.0
-14.4	6	42.8	5.0	41	105.8	24.4	76	168.8	68.3	155	311.0
-13.9	7	44.6	5.6	42	107.6	25.0	77	170.6	71.1	160	320.0
-13.3	8	46.4	6.1	43	109.4	25.6	78	172.4	73.9	165	329.0
-12.8	9	48.2	6.7	44	111.2	26.1	79	174.2	76.7	170	338.0
-12.2	10	50.0	7.2	45	113.0	26.7	80	176.0	79.4	175	347.0

PC160LC-7E0, PC180LC/NLC-7E0 Hydraulic excavator

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HYDRAULIC EXCAVATOR

PC160LC-7E0
PC180LC-7E0
PC180NLC-7E0

Machine model	Serial number
PC160LC-7E0	K45001 and up
PC180LC-7E0	K45001 and up
PC180NLC-7E0	K45001 and up

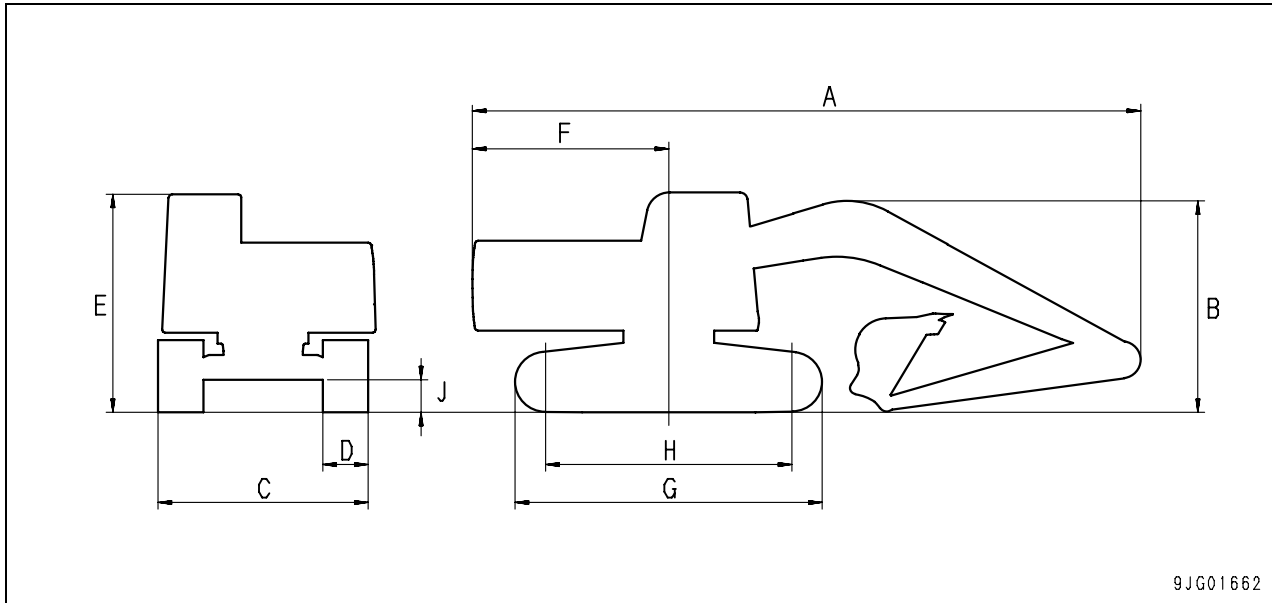
01 Specification

Specification and technical data

Specification dimension drawings	2
Specifications	4
Weight table	6
Table of fuel, coolant and lubricants.....	8

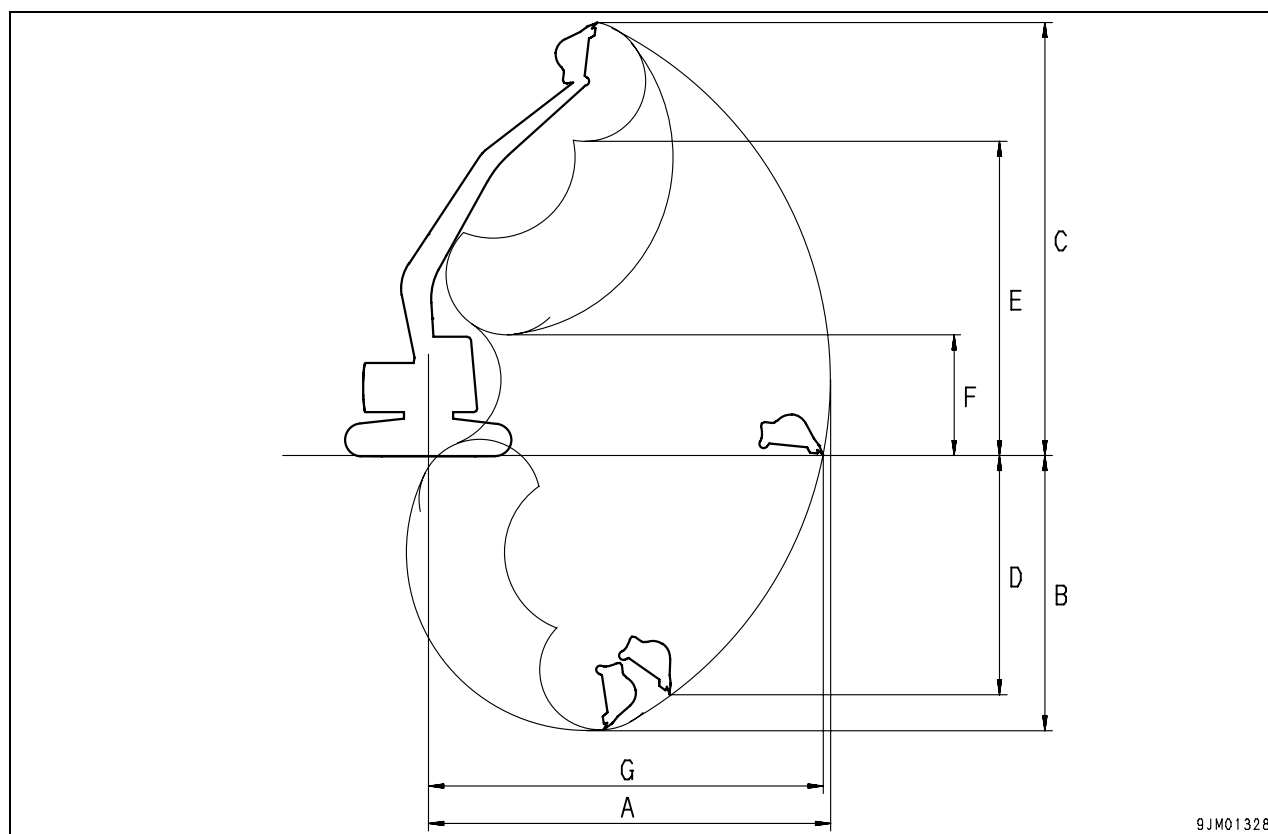
Specification dimension drawings

Dimension



	Check item	Unit	PC160LC-7E0	PC180LC-7E0	PC180NLC-7E0
A	Overall length	mm	8,565	8,565	8,565
B	Overall height	mm	3,000	3,000	3,000
C	Overall width	mm	2,490	2,800	2,700
D	Shoe width	mm	500	600	500
E	Cab height	mm	2,970	2,970	2,970
F	Tail swing radius	mm	2,435	2,435	2,435
G	Overall track length	mm	3,965	4,065	4,065
H	Length of track on ground	mm	3,170	3,275	3,275
J	Min. ground length	mm	440	440	440

Working range diagram



	Check item	Unit	PC160LC-7E0	PC180LC-7E0	PC180NLC-7E0
A	Max. digging reach	mm	8,960	8,960	8,960
B	Max. digging depth	mm	5,960	5,960	5,960
C	Max. digging height	mm	8,980	8,980	8,980
D	Max. vertical wall digging depth	mm	5,040	5,040	5,040
E	Max. dumping height	mm	6,370	6,370	6,370
F	Min. dumping height	mm	2,400	2,400	2,400
G	Max. reach at ground level	mm	8,800	8,800	8,800

Specifications

Machine model			PC160LC-7E0	PC180LC-7E0	PC180NLC-7E0
Serial number			K45001 and up	K45001 and up	K45001 and up
Bucket capacity		m ³	0.65	0.65	0.65
Operating weight		kg	16,400	18,650	18,520
Performance	Working range	Max. digging depth	mm	5,960	5,960
		Max. vertical wall depth	mm	5,040	5,040
		Max. digging reach	mm	8,960	8,960
		Max. reach at ground level	mm	8,800	8,800
		Max. digging height	mm	8,980	8,980
		Max. dumping height	mm	6,370	6,370
	Max. digging force (using power max. function)		kN {kg}	112.8 {11,500} (122.6 {12,500})	112.8 {11,500} (122.6 {12,500})
	Swing speed		rpm	12	12
	Swing max. slope angle		deg.	20	20
	Travel speed		km/h	Lo: 3.4 Hi: 5.5	Lo: 3.4 Hi: 5.5
	Gradeability		deg.	35	35
	Ground pressure (standard shoe width)		kPa {kg/cm ² } (mm)	46.1 {0.47} (500)	48.0 {0.49} (500)
	Dimensions	Overall length (for transport)	mm	8,565	8,565
		Overall width	mm	2,490	2,490
		Overall width of track	mm	2,490	2,700
		Overall height (for transport)	mm	3,025	3,025
		Overall height to chassis	mm	2,970	2,970
		Ground clearance to bottom of upper structure	mm	1,055	1,055
		Min. ground clearance	mm	440	440
		Tail swing radius	mm	2,435	2,435
		Min. swing radius of work equipment	mm	2,990	2,990
		Height of work equipment at min. swing radius	mm	7,185	7,185
		Length of track on ground	mm	3,170	3,275
		Track gauge	mm	1,990	2,200
		Height of machine cab	mm	2,090	2,090

Machine model			PC160LC-7E0, PC180LC/NLC-7E0		
Serial number			K45001 and up		
Engine	Model		SAA4D107E-1		
	Type		4-cycle, water-cooled, in-line, vertical, direct injection, with turbocharger and aftercooler		
	No. of cylinders - bore x stroke		mm	4 – 107 x 124	
	Piston displacement		ℓ {cc}	4.460 {4,460}	
	Performance	Flywheel horsepower	kW/rpm {HP/rpm}	86/2,200 {117/2,200}	
		Max. torque	Nm/rpm {kgm/rpm}	464/1,500 {47.3/1,500}	
		Max. speed at no load	rpm	2,320	
		Min. speed at no load	rpm	1,050	
		Min. fuel consumption	g/kWh{g/HPh}	220 {162}	
	Starting motor			24 V, 4.5 kW	
	Alternator			24 V, 60 A	
	Battery			12 V, 120 Ah x 2	
	Radiator core type			Corrugated aluminium	
Undercarriage	Carrier roller			2 on each side	
	Track roller			7 on each side	
	Track shoe			Assembly-type triple grouser, 44 on each side	
Hydraulic system	Hydraulic pump	Type x No.		HPD71, variable capacity piston type	
		Delivery	ℓ/min	Piston type: 156 x 2	
		Set pressure	MPa {kg/cm ² }	31.4 {320}	
	Control valve	Type x No.		6-spool type x 1	
		Control method		Hydraulic type	
	Hydraulic motor	Travel motor		HMV110ADT-3, Variable capacity piston type (with brake valve, parking brake x 2)	
		Swing motor		MSG-85P-17TR fixed capacity, Piston type (with safety valve, holding brake x 2)	
	Hydraulic cylinder	Type		Boom (*1)	Arm (*1, *2)
				Double acting piston	Double acting piston
		Inside diameter of cylinder	mm	110	120
		Diameter of piston rod	mm	75	85
		Stroke	mm	1,175	1,342
		Max. distance between pins	mm	2,810	3,246
		Min. distance between pins	mm	1,635	1,904
	Hydraulic tank			Closed box type	
	Hydraulic filter			Tank return side	
	Hydraulic cooler			CF40-1 (Air cooled)	

*1. With cushion on head side

*2. With cushion on bottom side

Weight table

⚠ This weight table is for use when handling components or when transporting the machine.

				Unit: kg
Machine model	PC160LC-7E0	PC180LC-7E0	PC180NLC-7E0	
Serial number	K45001 and up	K45001 and up	K45001 and up	
Engine assembly	594	594	594	
• Engine	467	467	467	
• Damper	6	6	6	
• Hydraulic pump	121	121	121	
Radiator, oil cooler assembly	137	137	137	
Hydraulic tank, filter assembly (excluding hydraulic oil)	112	112	112	
Fuel tank (excluding fuel)	114	114	114	
Revolving frame	1,514	1,586	1,586	
Operator's cab	278	278	278	
Operator's seat	35	35	35	
Counterweight	2,850	3,554	3,554	
Swing machinery (including swing motor)	176	176	176	
Main control valve	125	125	125	
Travel motor	98 x 2	98 x 2	98 x 2	
Centre swivel joint	36	36	36	
Track frame assembly	3,866	4,114	4,014	
• Track frame	1,972	2,220	2,210	
• Swing circle	222	222	222	
• Idler	101 x 2	101 x 2	101 x 2	
• Idler cushion	118 x 2	118 x 2	118 x 2	
• Carrier roller	14 x 4	14 x 4	14 x 4	
• Track roller	36 x 14	36 x 14	36 x 14	
• Final drive (including travel motor)	337 x 2	337 x 2	337 x 2	
Track shoe assembly				
• Standard triple grouser shoe (500 mm)	1,080 x 2	1,140 x 2	1,140 x 2	
• Standard triple grouser shoe (600 mm)	1,190 x 2	1,260 x 2	1,260 x 2	
• Standard triple grouser shoe (700 mm)	1,300 x 2	1,390 x 2	1,390 x 2	
• Wide triple grouser shoe (800 mm)	1,410 x 2	1,510 x 2	1,510 x 2	

				Unit: kg
Machine model	PC160LC-7E0	PC180LC-7E0	PC180NLC-7E0	
Serial number	K45001 and up	K45001 and up	K45001 and up	
Boom assembly	1,085	1,085	1,085	
Arm assembly	508	508	508	
Bucket assembly	500	500	500	
Boom cylinder assembly	125 x 2	125 x 2	125 x 2	
Arm cylinder assembly	172	172	172	
Bucket cylinder assembly	98	98	98	
Front link assembly	33 x 2	33 x 2	33 x 2	
List link assembly	19 x 2	19 x 2	19 x 2	
Boom pin	29 + 6 x 2 + 21 + 10 + 19	29 + 6 x 2 + 21 + 10 + 19	29 + 6 x 2 + 21 + 10 + 19	
Arm pin	11 + 7	11 + 7	11 + 7	
Bucket pin	15 x 2	15 x 2	15 x 2	
Link pin	15 x 2	15 x 2	15 x 2	

Table of fuel, coolant and lubricants

★ For details of the notes (Note 1, Note 2...) in the table, see Operation and Maintenance Manual.

Reservoir	Fluid Type	Ambient Temperature, degrees Celsius									Recommended Komatsu Fluids
		-22	-4	14	32	50	68	86	104	122°F	
		-30	-20	-10	0	10	20	30	40	50°C	
Engine oil pan	Engine oil	<div>(Note.1)</div>									Komatsu EOS0W30
		<div>(Note.1)</div>									Komatsu EOS5W40
											Komatsu EO10W30-DH
											Komatsu EO15W40-DH
											Komatsu EO30-DH
Swing machinery case Final drive case Damper case	Powertrain oil (Note.2)										TO30
Hydraulic system	Powertrain oil										TO10
	Hydraulic oil										HO46-HM
Grease fitting	Hyper grease (Note.3)										G2-T, G2-TE
	Lithium EP grease										G2-LI
Cooling system	Supercoolant AF-NAC (Note.4)										AF-NAC
Fuel tank	Diesel fuel										ASTM Grade No.1-D S15 ASTM Grade No.1-D S500
											ASTM Grade No.2-D S15 ASTM Grade No.2-D S500

Unit: ℓ

Refilling points	PC160LC-7E0, PC180LC-7E0 and PC180NLC-7E0			
	Specified capacity		Refill capacity	
	Litre	US gal	Litre	US gal
Engine oil pan	17.9	4.73	16.0	4.23
Swing machinery case	4.5	1.19	4.5	1.19
Final drive case (both sides)	3.5	0.92	3.3	0.87
Damper case	0.85	0.22	0.85	0.22
Hydraulic oil system	190	50.20	121	31.97
Fuel tank	280	73.98	—	—
Cooling system	18.5	4.89	—	—

PC160LC-7E0, PC180LC/NLC-7E0 Hydraulic excavator

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HYDRAULIC EXCAVATOR

PC160LC-7E0

PC180LC-7E0

PC180NLC-7E0

Machine model	Serial number
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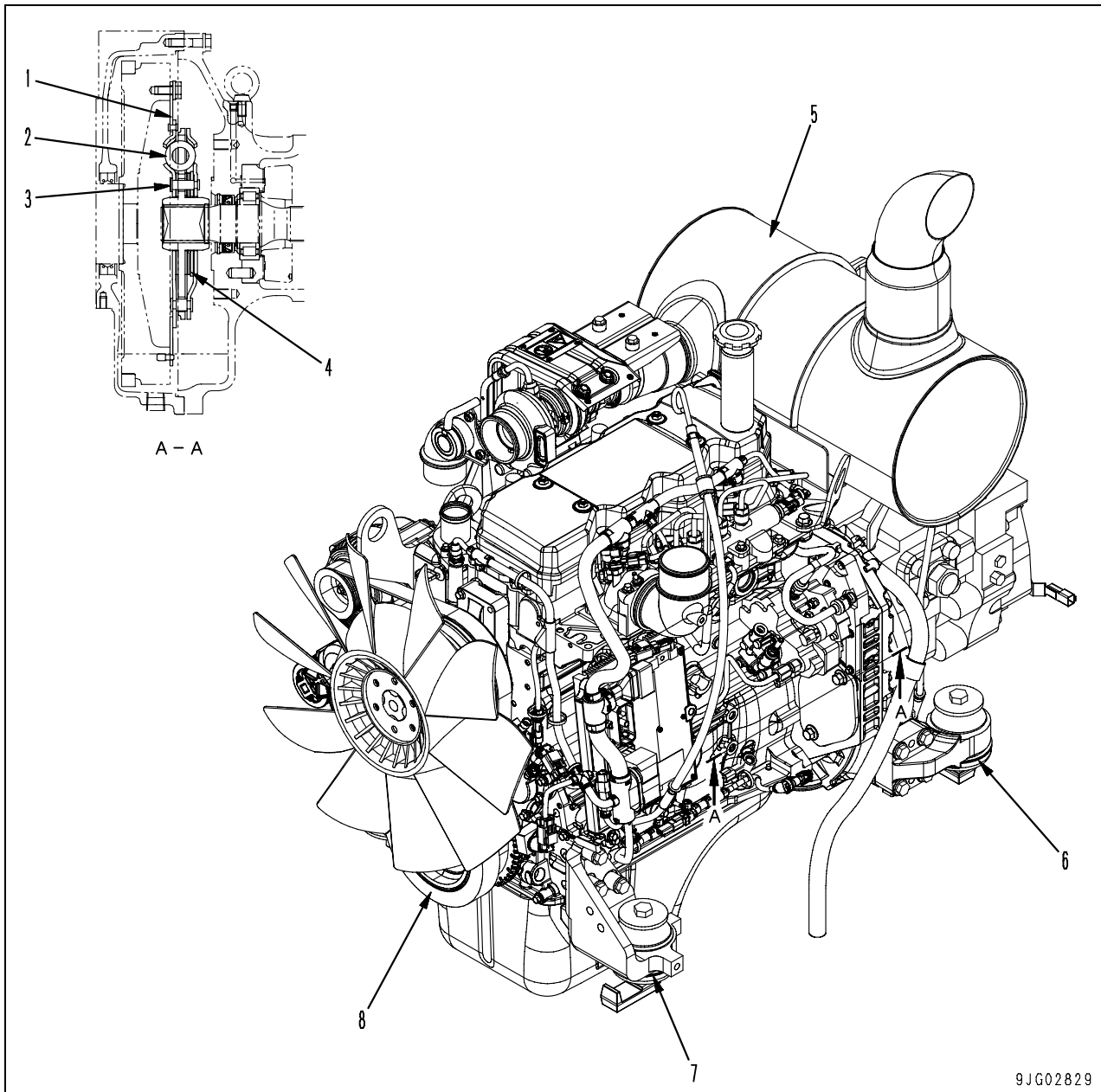
PC160LC-7E0	K45001 and up
PC180LC-7E0	K45001 and up
PC180NLC-7E0	K45001 and up

10 Structure, function and maintenance standard

Engine and cooling system

Engine related parts	2
Radiator, oil cooler, aftercooler and fuel cooler	3

Engine related parts

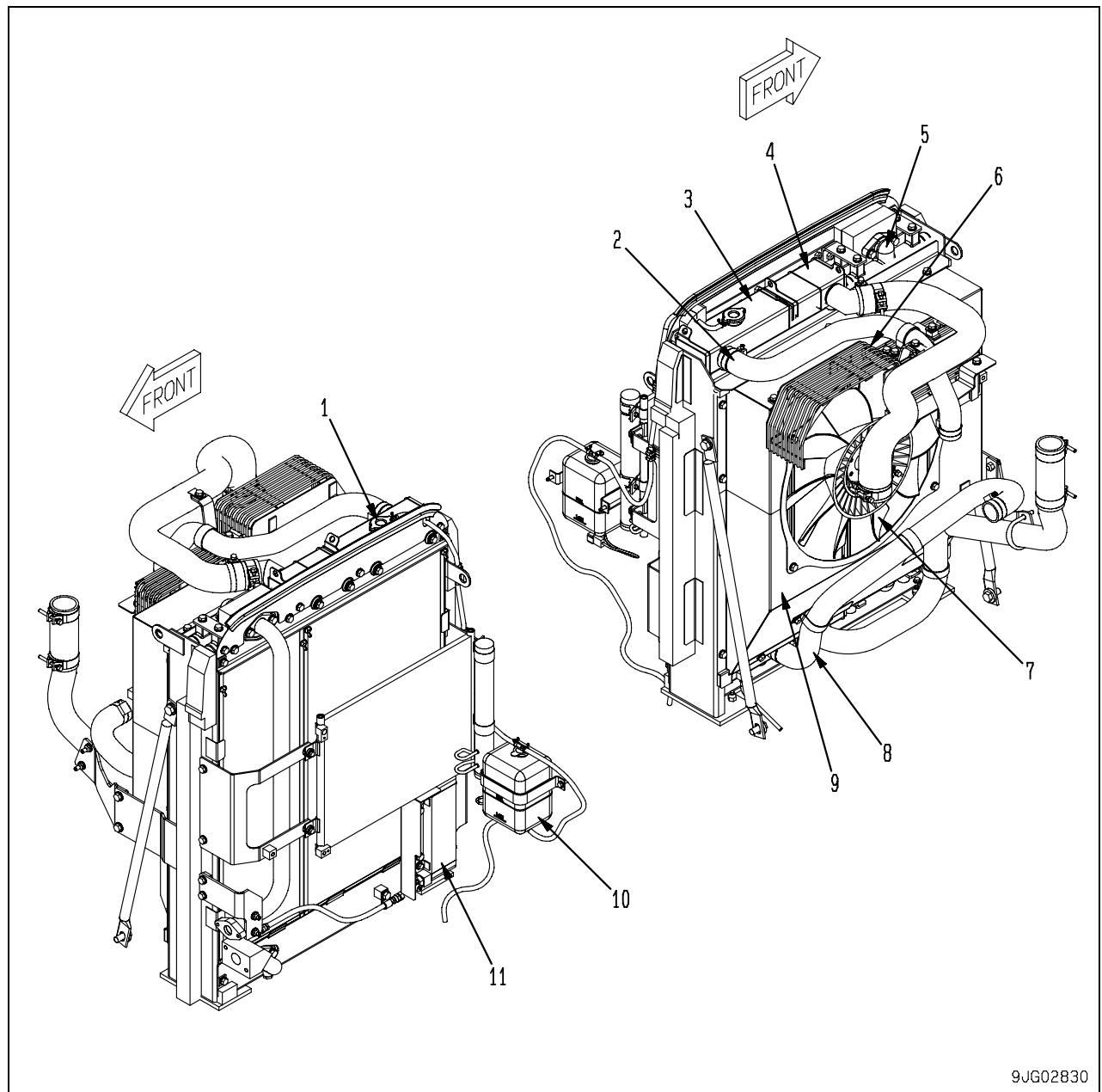


1. Drive plate
2. Torsion spring
3. Stopper pin
4. Friction plate
5. Muffler
6. Rear engine mount
7. Front engine mount
8. Damper assembly

Outline

A damper assembly is wet type.
Oil capacity: 0.85 ℓ

Radiator, oil cooler, aftercooler and fuel cooler



1. Radiator cap
2. Radiator inlet hose
3. Radiator
4. Aftercooler
5. Oil cooler
6. Net
7. Fan
8. Radiator outlet hose
9. Shroud
10. Reservoir tank
11. Fuel cooler

Specifications

Radiator : Corrugated aluminium

Oil cooler : CF40-1

Aftercooler : Corrugated aluminium

Fuel cooler : Drawn cup

PC160LC-7E0, PC180LC/NLC-7E0 Hydraulic excavator

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HYDRAULIC EXCAVATOR

PC160LC-7E0

PC180LC-7E0

PC180NLC-7E0

Machine model	Serial number
---------------	---------------

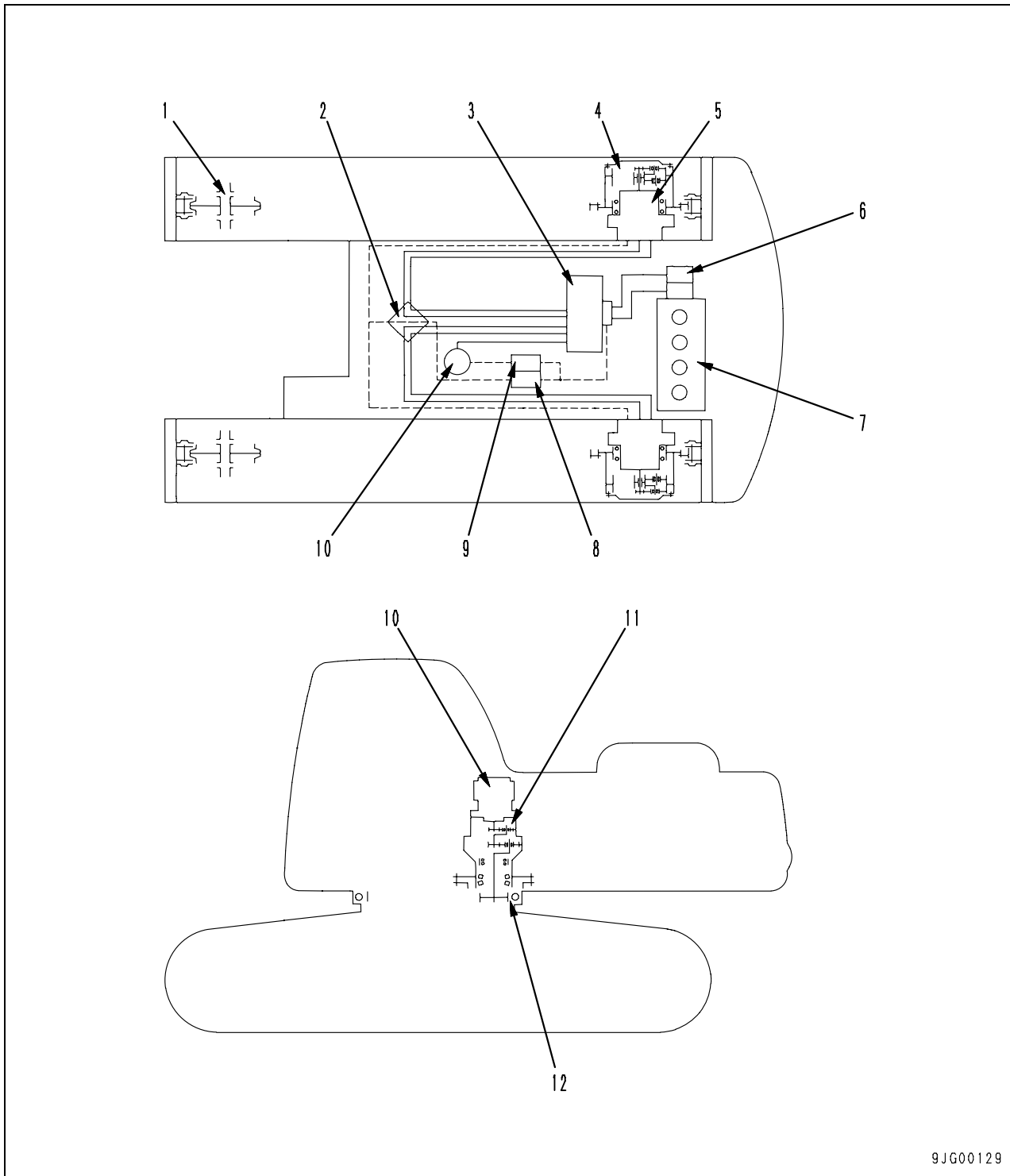
PC160LC-7E0	K45001 and up
PC180LC-7E0	K45001 and up
PC180NLC-7E0	K45001 and up

10 Structure, function and maintenance standard

Power train system

Power train.....	2
Swing circle.....	3
Swing machinery.....	4
Final drive	6
Sprocket.....	8

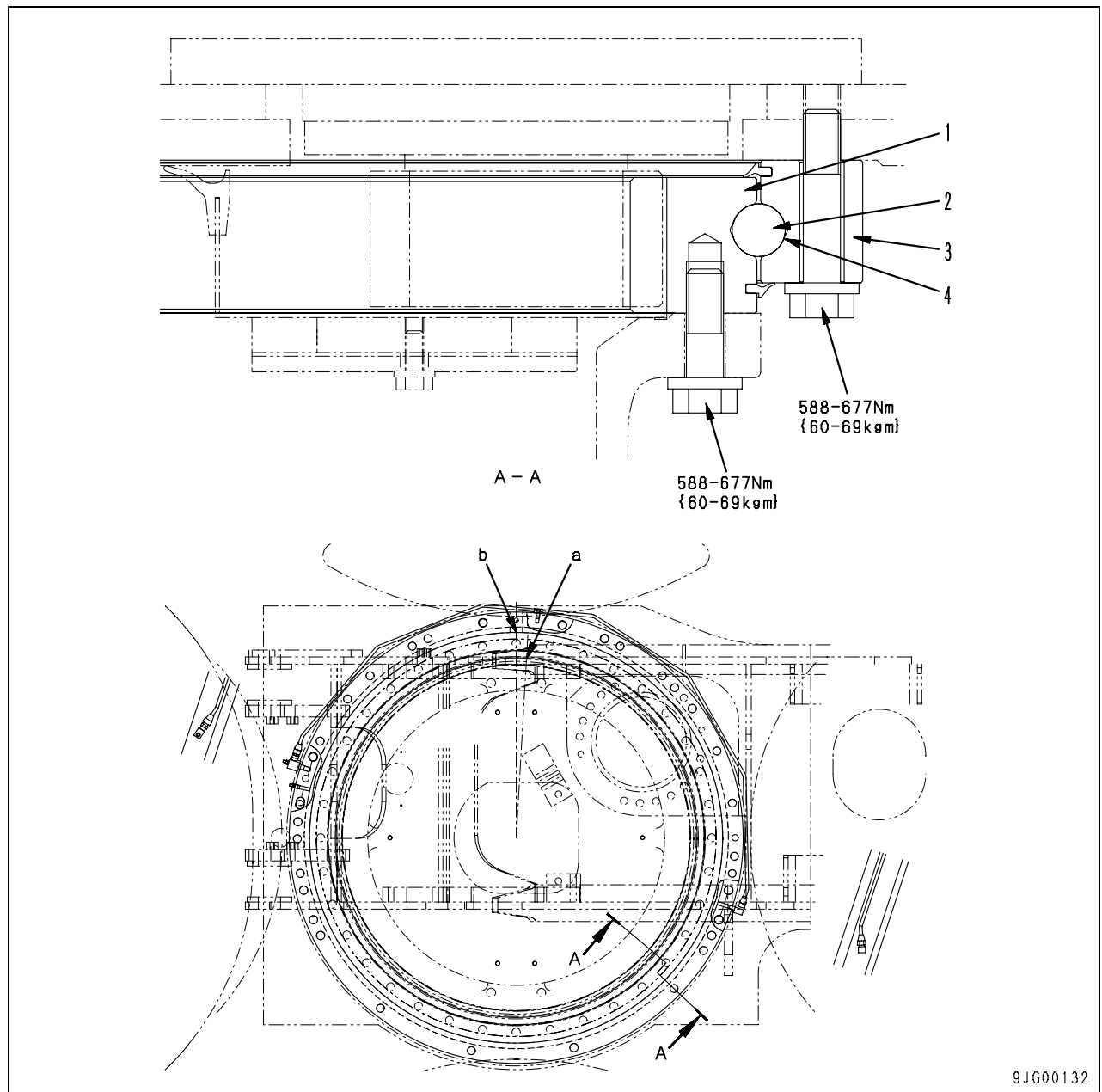
Power train



9JG00129

- | | |
|--------------------------------|--------------------------------|
| 1. Idler | 7. Engine |
| 2. Centre swivel joint | 8. Travel speed solenoid valve |
| 3. Control valve | 9. Swing brake solenoid valve |
| 4. Final drive | 10. Swing motor (MSG-85P-17TR) |
| 5. Travel motor (HMT 110ADT-3) | 11. Swing machinery |
| 6. Hydraulic pump (HPD71) | 12. Swing circle |

Swing circle



1. Swing circle inner race (No. of teeth: 99)
2. Ball
3. Swing circle outer race

Specifications

Reduction ratio: $99/13 = 7.615$

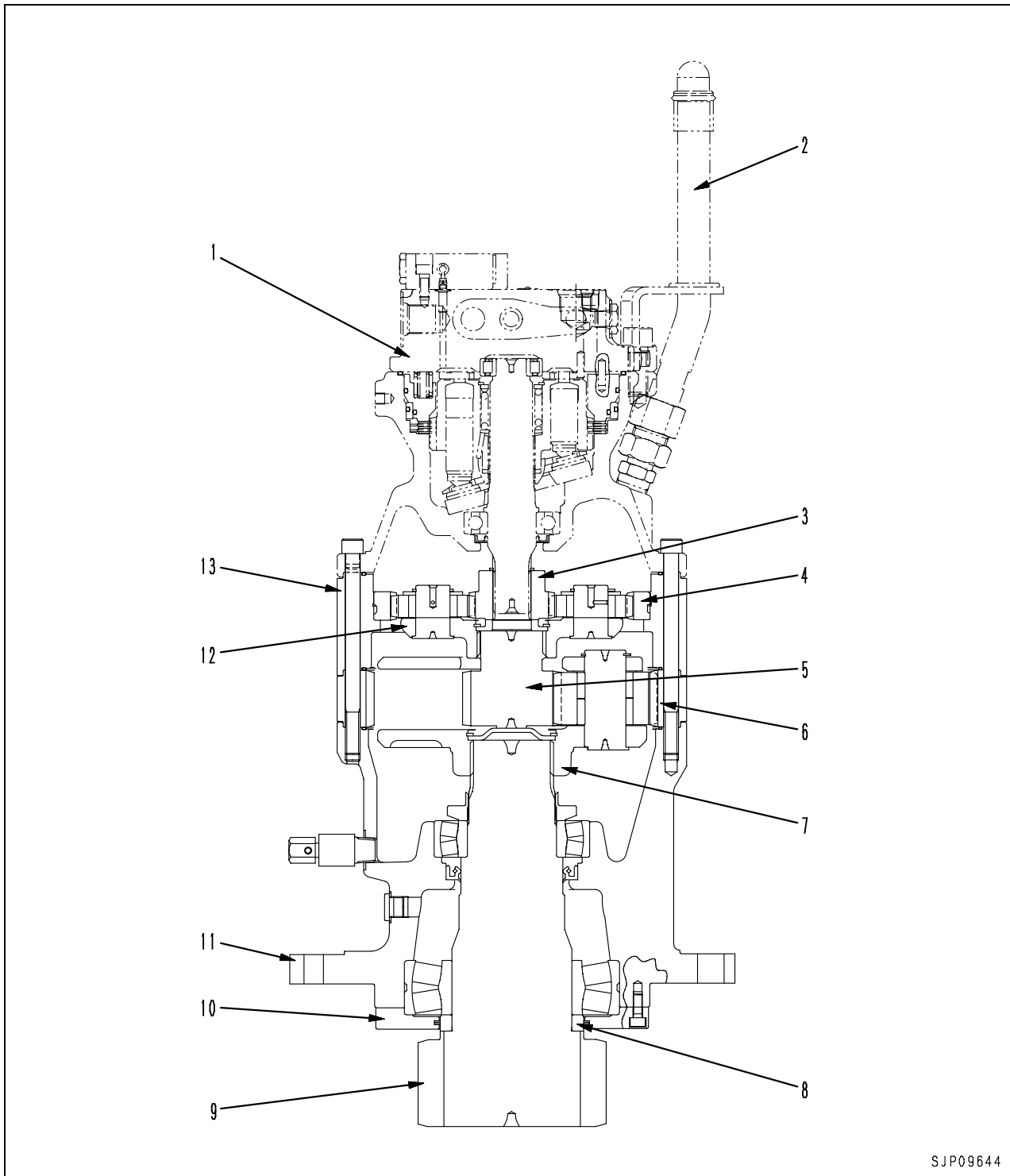
Amount of grease: 10.5 ℓ (G2-LI)

- a. Inner race soft zone S position
- b. Outer race soft zone S position

Unit: mm

No.	Check item	Criteria		Remedy
		Standard clearance	Clearance limit	
4	Axial clearance of bearing (when mounted on chassis)	0.5 – 1.6	3.2	Replace

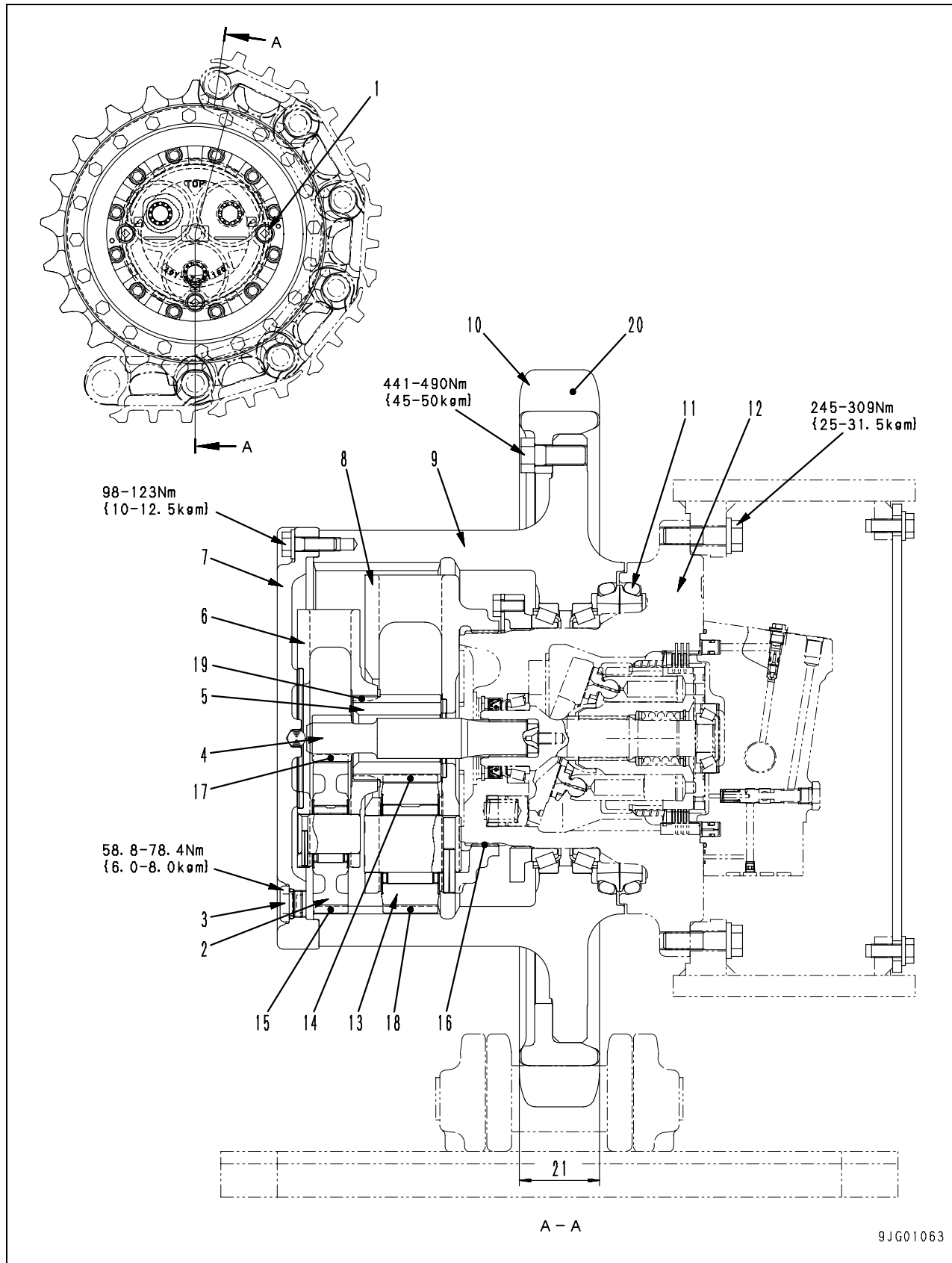
Swing machinery



SJP09644

- | | |
|----------------------------|-----------------------------|
| 1. Swing motor assembly | 8. Collar |
| 2. Oil level gauge | 9. Swing pinion |
| 3. No. 1 sun gear | 10. Cover |
| 4. No. 1 planetary gear | 11. Case |
| 5. No. 2 sun gear | 12. No. 1 planetary carrier |
| 6. No. 2 planetary gear | 13. Ring gear |
| 7. No. 2 planetary carrier | |

Final drive



1. Level plug
2. No. 1 planetary gear (No. of teeth: 42)
3. Drain plug
4. No. 1 sun gear (No. of teeth: 10)
5. No. 2 sun gear (No. of teeth: 21)
6. No. 1 planetary carrier
7. Cover
8. No. 2 planetary carrier
9. Gear hub (No. of teeth: 95)
10. Sprocket
11. Floating seal
12. Travel motor
13. No. 2 planetary gear (No. of teeth: 36)

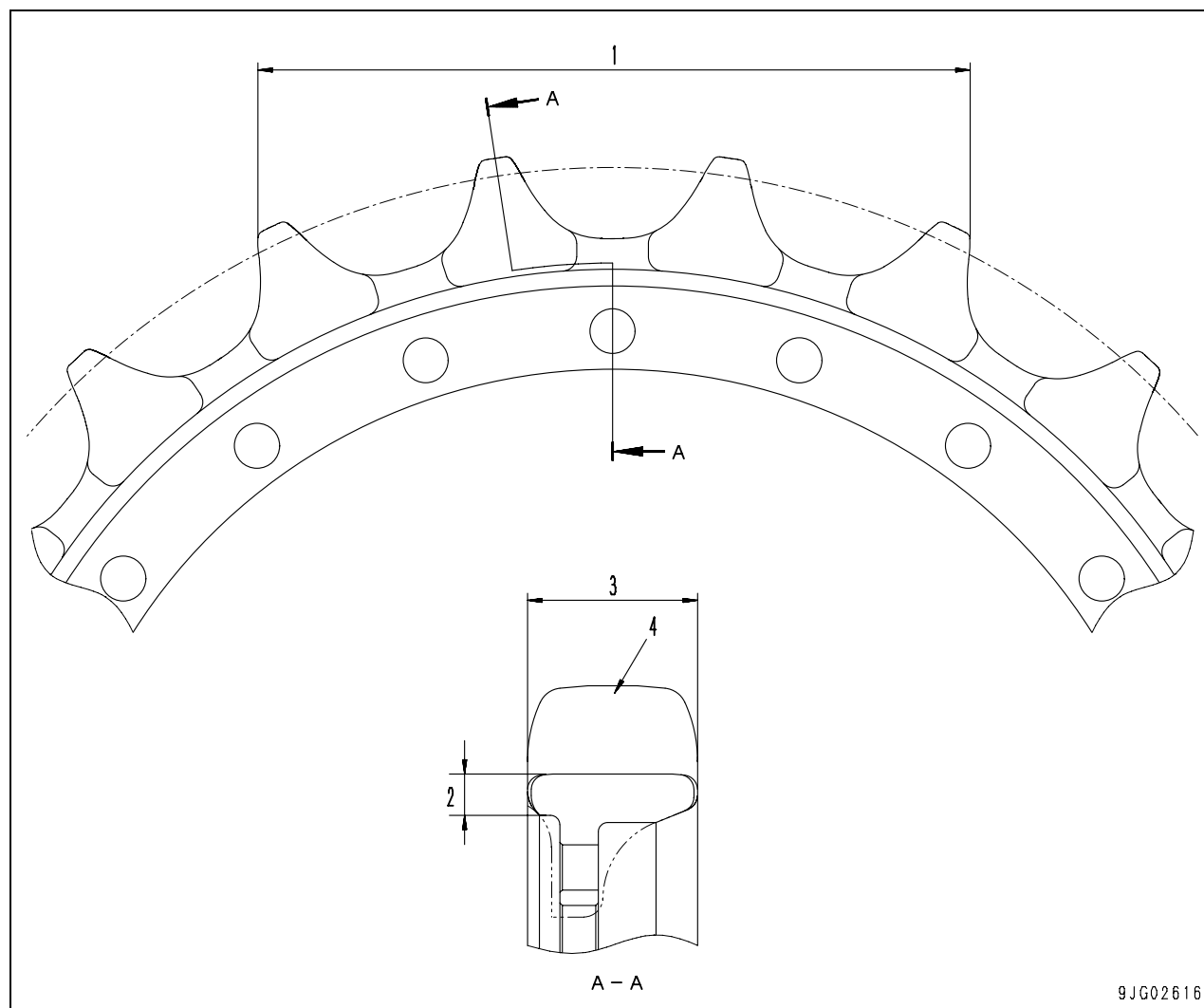
Specifications

Reduction ratio: $-\left(\frac{10+95}{10}\right) \times \left(\frac{21+95}{21}\right) + 1 = -57.000$

Unit: mm

No.	Check item	Criteria		Remedy
14	Backlash between No. 2 sun gear and No.2 planetary gear	Standard clearance	Clearance limit	Replace
		0.13 – 0.47	1.00	
15	Backlash between No. 1 planetary gear and gear hub	0.17 – 0.57	1.10	
16	Backlash between No. 2 planetary carrier and motor	0.06 – 0.25	—	
17	Backlash between No. 1 sun gear and No.1 planetary gear	0.14 – 0.46	1.00	
18	Backlash between No. 2 planetary gear and gear hub	0.16 – 0.56	1.10	
19	Backlash between No. 1 planetary carrier and No. 2 sun gear	0.38 – 0.66	1.00	
20	Amount of wear on sprocket tooth	Repair limit: 6		Build-up welding or replace
21	Width of sprocket tooth	Standard size	Repair limit	
		71	68	

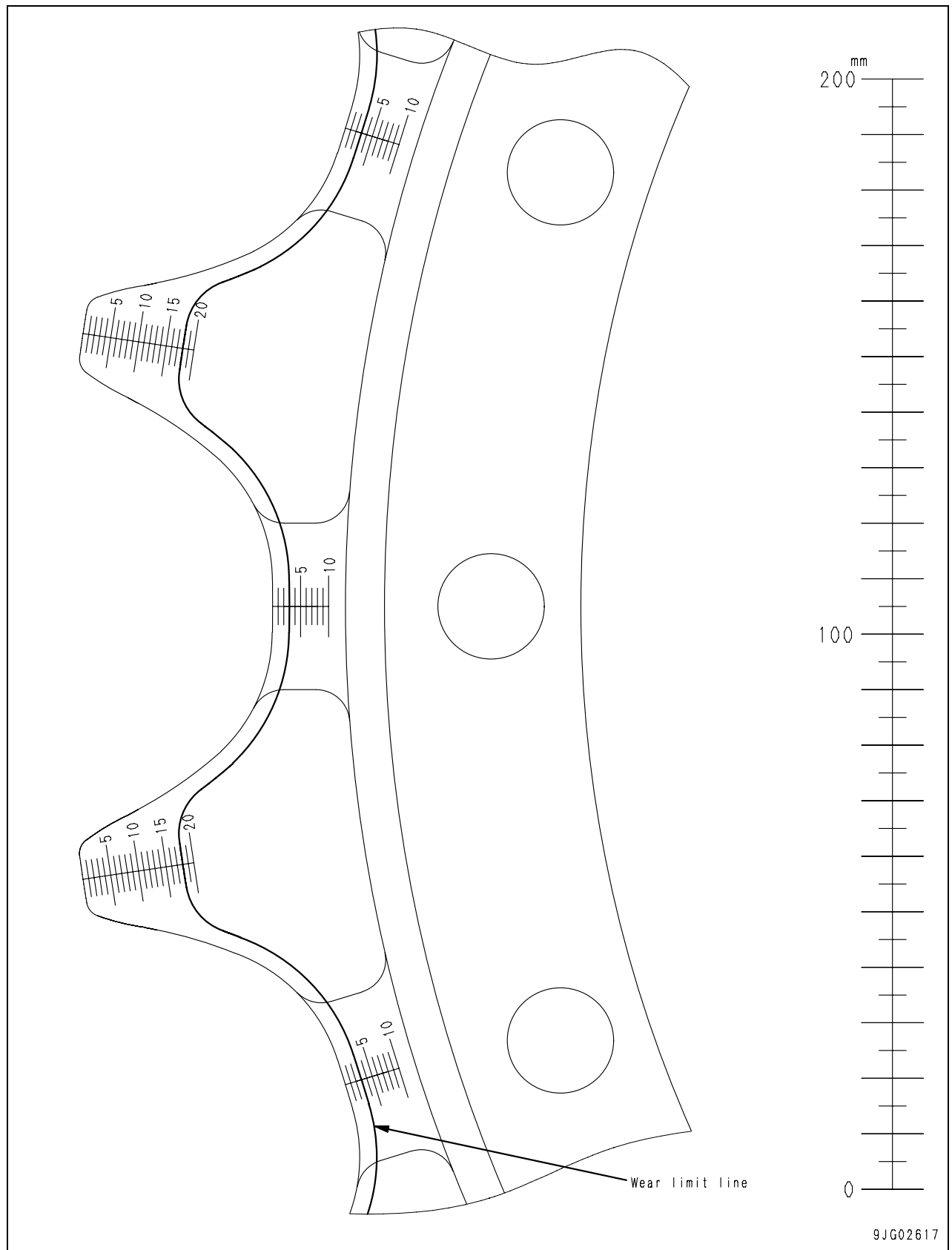
Sprocket



Unit: mm

No.	Check item	Criteria		Remedy
1	Wear of tooth tip	Standard size	Repair limit	Build-up welding or replace
		294.5	282.5	
2	Thickness of tooth root	17	11	
3	Width of tooth	71	68	
4	Amount of wear on tooth	Repair limit: 6 (measure with sprocket tooth shape)		

Sprocket tooth shape of real dimension



PC160LC-7E0, PC180LC/NLC-7E0 Hydraulic excavator

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HYDRAULIC EXCAVATOR

PC160LC-7E0

PC180LC-7E0

PC180NLC-7E0

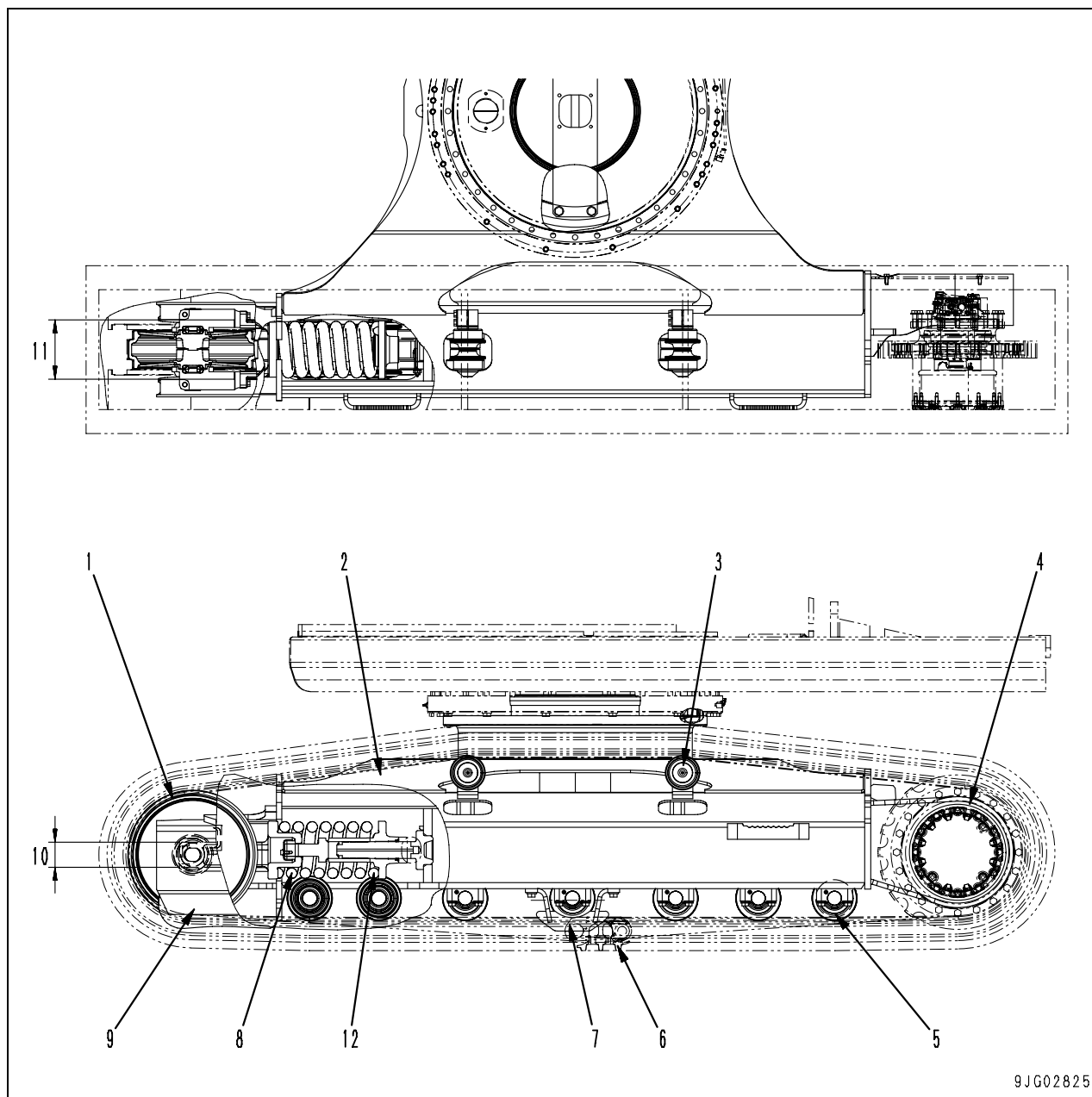
Machine model	Serial number
PC160LC-7E0	K45001 and up
PC180LC-7E0	K45001 and up
PC180NLC-7E0	K45001 and up

10 Structure, function and maintenance standard

Undercarriage and frame

Track frame, recoil spring.....	2
Idler	4
Carrier roller	6
Track roller	7
Track shoe	8

Track frame, recoil spring



1. Idler
2. Track frame
3. Carrier roller
4. Final drive
5. Track roller
6. Track shoe
7. Centre guard
8. Recoil spring
9. Front guard

- The dimensions and the number of track rollers depend on the model, but the basic structure is not different.
- Number of track rollers

Model	Q'ty (One side)
PC160LC-7E0	7
PC180LC/NLC-7E0	7

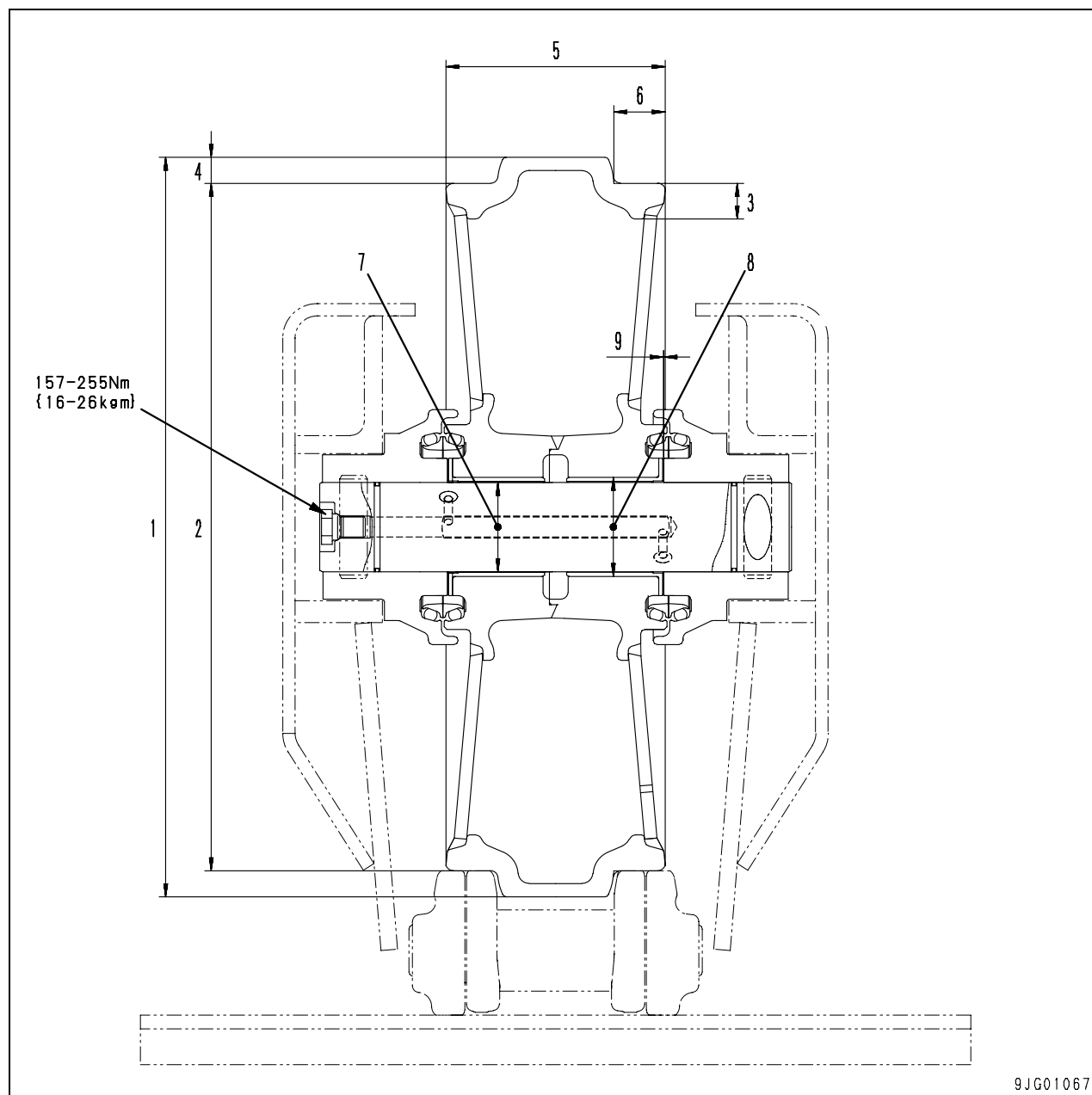
Standard shoe

Item \ Model	PC160LC-7E0	PC180LC-7E0	PC180NLC-7E0
Shoe width	500 mm	600 mm	500 mm
Link pitch	190 mm	190 mm	190 mm
No. on track (one side)	44 (pieces)	45 (pieces)	45 (pieces)

Unit: mm

No.	Check item	Criteria				Remedy	
10	Vertical width of idler guide		Standard size	Tolerance	Repair limit	Rebuild or replace	
		Track frame	107				
		Idler support	105			Replace	
11	Horizontal width of idler guide	Track frame	250			Rebuild or replace	
		Idler support	247.4			Replace	
12	Recoil spring	Standard size			Repair limit		
		Free length x Outside diameter	Installation length	Installation load	Free length		Installation load
		558 x 238	417	109.3 kN {11,150 kg}	531.4	87.4 kN {8,920 kg}	

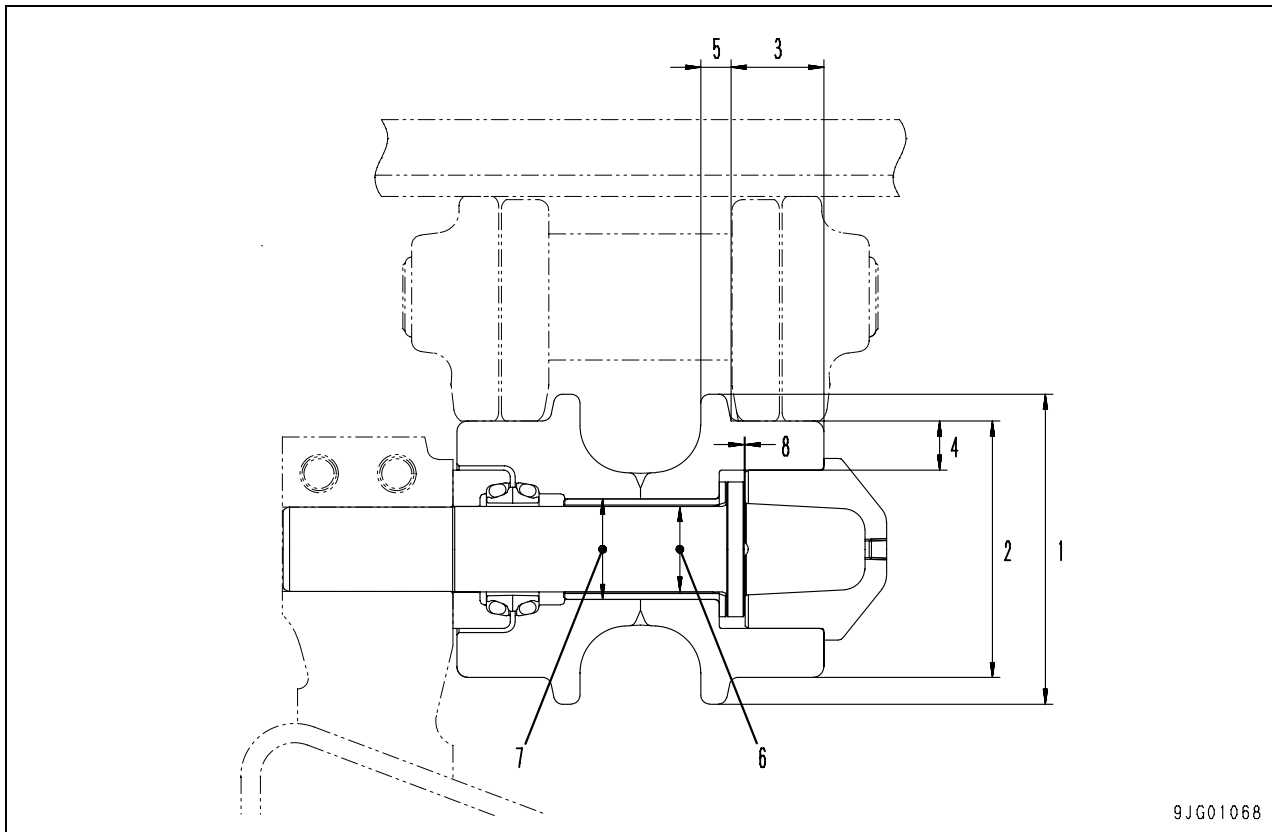
Idler



Unit: mm

No.	Check item	Criteria				Remedy
1	Outside diameter of protrusion	Standard size		Repair limit		Build-up welding or replace
		538		—		
2	Outside diameter of tread	500		488		
3	Thickness of tread	26		20		
4	Difference of tread	19		25		
5	Total width	159		—		
6	Width of tread	37.5		—		
7	Clearance between shaft and bushing	Standard size	Tolerance		Standard clearance	Clearance limit
			Shaft	Hole		
		65	−0.250 −0.350	+0.164 −0.074	0.176 – 0.514	—
8	Interference between idler and bushing	Standard size	Tolerance		Standard interference	Interference limit
			Shaft	Hole		
		72	+0.108 +0.008	−0.032 −0.062	0.040 – 0.170	—
9	Axial clearance of roller (Sum of clearance at both sides)	Standard clearance		Clearance limit		
		0.5 – 1.0		—		

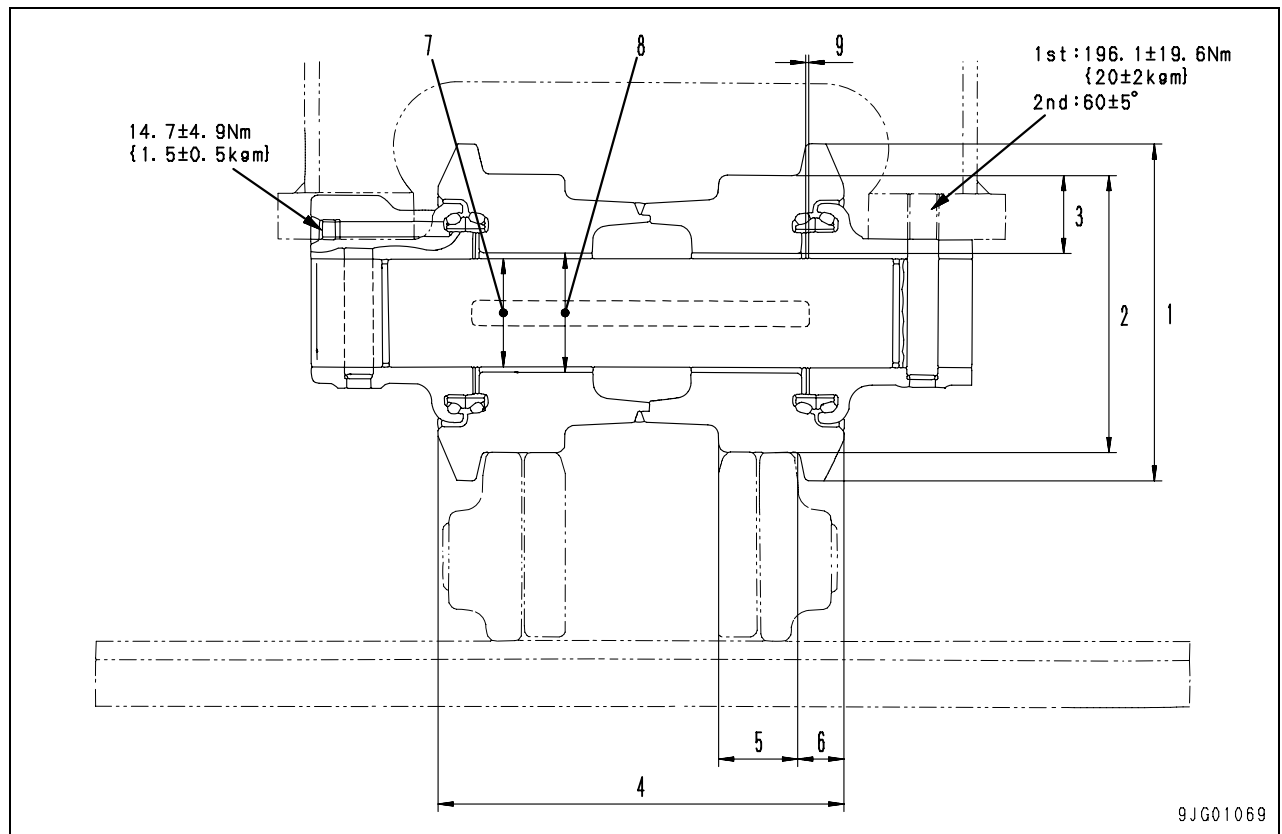
Carrier roller



Unit: mm

No.	Check item	Criteria					Remedy
1	Outside diameter of flange	Standard size		Repair limit			Replace
		145		—			
2	Outside diameter of tread	120		106			
3	Width of tread	43		—			
4	Thickness of tread	23		16			
5	Width of flange	14		—			
6	Clearance between shaft and bushing	Standard size	Tolerance		Standard clearance	Clearance limit	
			Shaft	Hole			
		40	−0.170 −0.190	+0.301 +0.168	0.338 – 0.491	—	
7	Interference between roller and bushing	Standard size	Tolerance		Standard interference	Interference limit	
			Shaft	Hole			
		47	+0.061 +0.016	0 −0.040	0.016 – 0.101	—	
8	Axial clearance of roller	Standard clearance		Clearance limit			
		0.44 – 0.76		—			

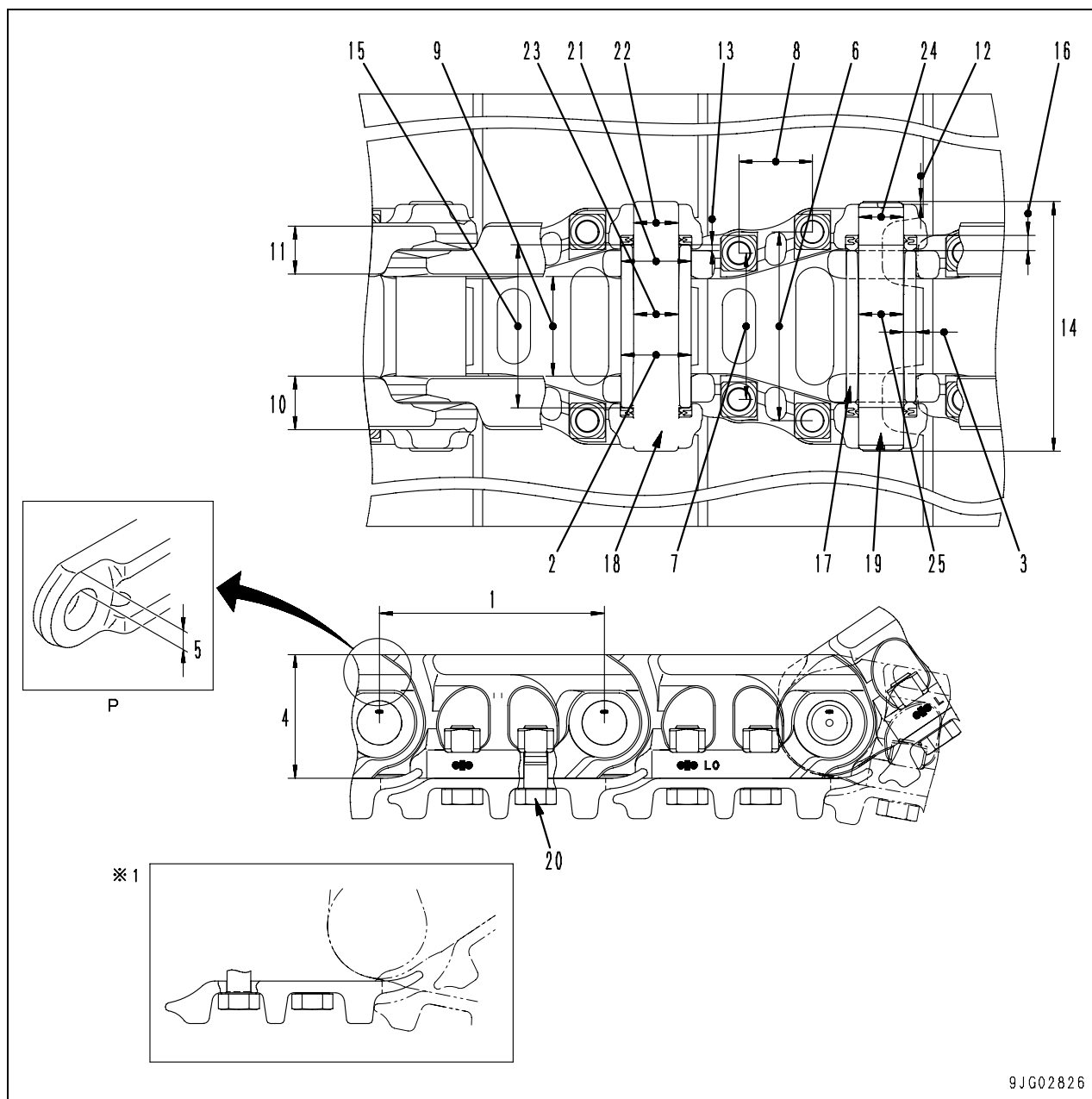
Track roller



Unit: mm

No.	Check item	Criteria					Remedy
1	Outside diameter of flange	Standard size		Repair limit			Build-up welding or replace
		188		—			
2	Outside diameter of tread	156		144			
3	Thickness of tread	44.5		38.5			
4	Total width	225		—			
5	Width of tread	44.5		—			
6	Width of flange	25.5		—			
7	Clearance between shaft and bushing	Standard size	Tolerance		Standard clearance	Clearance limit	Replace bushing
			Shaft	Hole			
		60	−0.215 −0.315	+0.195 0	0.215 – 0.510	—	
8	Interference between roller and bushing	Standard size	Tolerance		Standard interference	Interference limit	
			Shaft	Hole			
		67	+0.153 +0.053	+0.030 0	0.023 – 0.153	—	
9	Axial clearance of roller (Sum of clearance at both sides)	Standard clearance			Clearance limit		Replace
		0.5 – 1.0			—		

Track shoe



9JG02826

★ P portion shows the link of bushing press fitting end.

*1. Triple grouser shoe

● No. of shoes

Model	No. of shoes (each side)
PC160LC-7E0	44

Unit: mm

No.	Check item		Criteria		Remedy
1	Link pitch		Standard size	Repair limit	Reverse or replace
			190.3	193.3	
2	Outside diameter of bushing		Standard size	Reverse	
			59.3	54.3	
3	Thickness of bushing metal		10.4	5.4	
4	Link height		Standard size	Repair limit	Repair or replace
			105	97	
5	Thickness of link metal (bushing press-fitting portion)		28.5	20.5	
6	Shoe bolt pitch		160.4		Adjust or replace
7			124.4		
8			62		
9	Link	Inside width	84.8		
10		Overall width	45.4		
11		Tread width	39.6		
12	Protrusion of pin	Regular	2.5		
		Master	2.5		
13	Protrusion of bushing	Regular	4.85		
		Master	0.0		
14	Overall length of pin	Regular	212		
		Master	212		
15	Overall length of bushing	Regular	138.5		
		Master	128.7		
16	Thickness of spacer		—		
17	Press-fitting force (*)	Bushing	88.2 – 245 kN {9 – 25 ton}		
18		Regular pin	127.4 – 274.4 kN {13 – 28 ton}		
19		Master pin	78.4 – 147 kN {8 – 15 ton}		

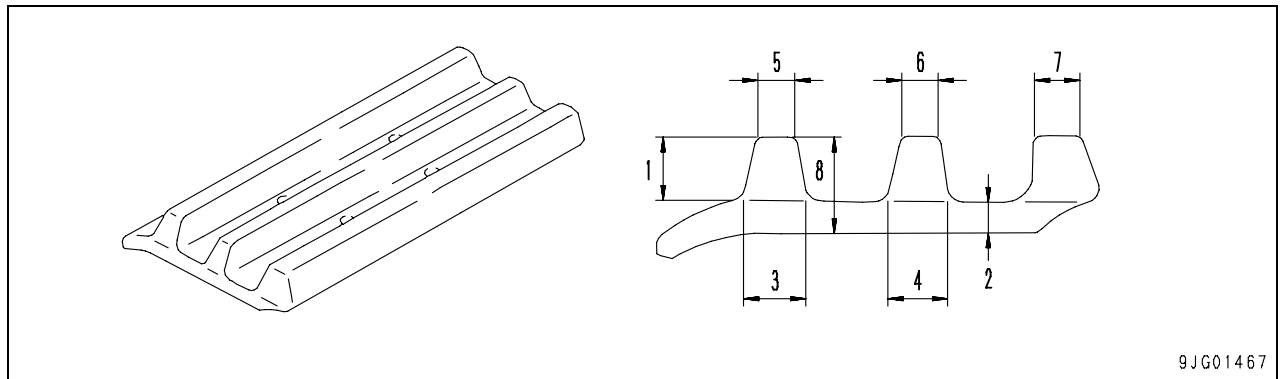
* Dry type track link

Unit: mm

No.	Check item		Criteria			Remedy
20	Shoe bolt	a. Regular link	Tightening torque (Nm {kgm})		Retightening angle (deg.)	Retighten
			Triple grouser shoe	490 ± 49 {50 ± 5}	120 ± 10	
		b. Master link	Tightening torque (Nm {kgm})	Retightening angle (deg.)	Lower limit torque (Nm {kgm})	
			—	—	—	
21	Interference between bushing and link		Standard size	Tolerance		Standard interference
				Shaft	Hole	
			59	+0.434 +0.394	+0.074 0	0.320 – 0.434
22	Interference between regular pin and link		38	+0.222 +0.162	–0.138 –0.200	0.300 – 0.422
23	Clearance between regular pin and bushing		Standard size	Tolerance		Standard clearance
				Shaft	Hole	
			38	+0.222 +0.162	+0.902 +0.402	0.180 – 0.740
24 (*)	Interference between master pin and link		Standard size	Tolerance		Standard interference
				Shaft	Hole	
			37.8	+0.280 +0.250	+0.062 0	0.188 – 0.280
25 (*)	Clearance between master pin and bushing		Standard size	Tolerance		Standard clearance
				Shaft	Hole	
			38	–0.150 –0.350	+0.902 +0.402	0.552 – 1.252

* Dry type track link

Triple grouser shoe



9JG01467

Unit: mm

No.	Check item	Criteria		Remedy
1	Height	Standard size	Repair limit	Build-up welding or replace
		26	16	
2	Thickness	8.5		
3	Length of base	26		
4	Length of base	19		
5	Length at tip	20		
6	Length at tip	14		
7	Length at tip	19		
8	Thickness	Standard size	Repair limit	
		34.5	24.5	

PC160LC-7E0, PC180LC/NLC-7E0 Hydraulic excavator

Form No. UEN01901-00

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HYDRAULIC EXCAVATOR

PC160LC-7E0
PC180LC-7E0
PC180NLC-7E0

Machine model	Serial number
PC160LC-7E0	K45001 and up
PC180LC-7E0	K45001 and up
PC180NLC-7E0	K45001 and up

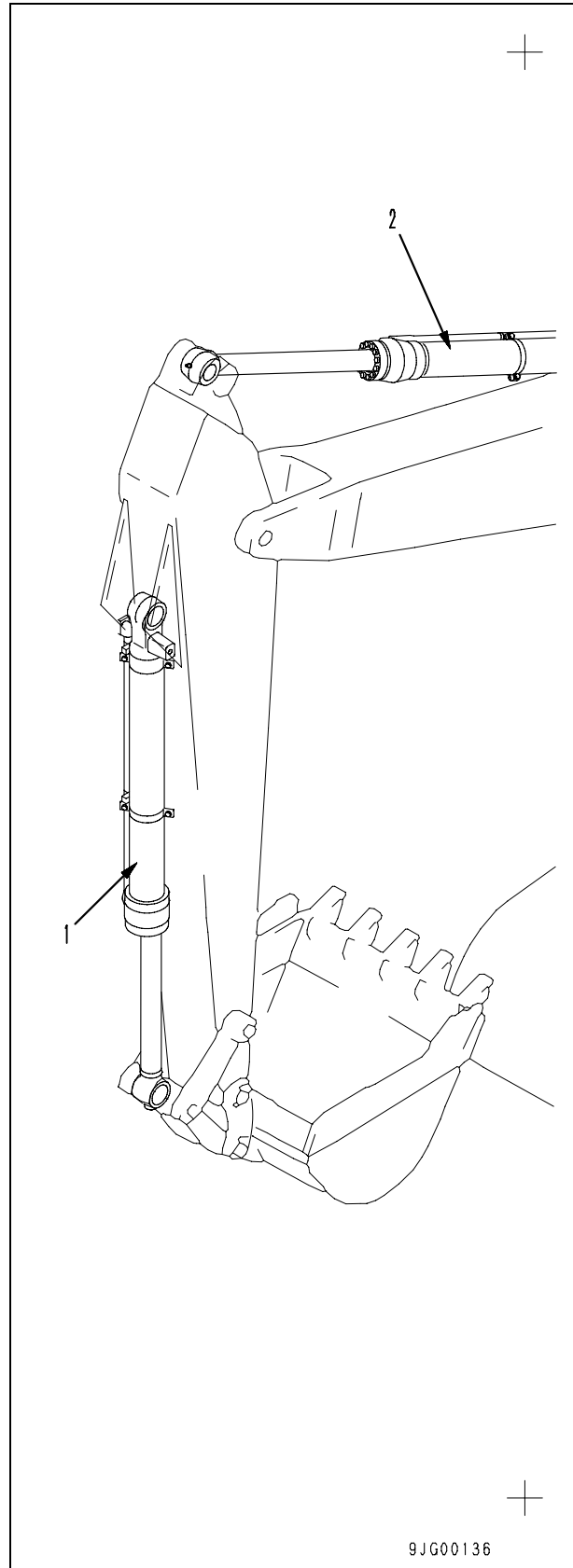
10 Structure, function and maintenance standard

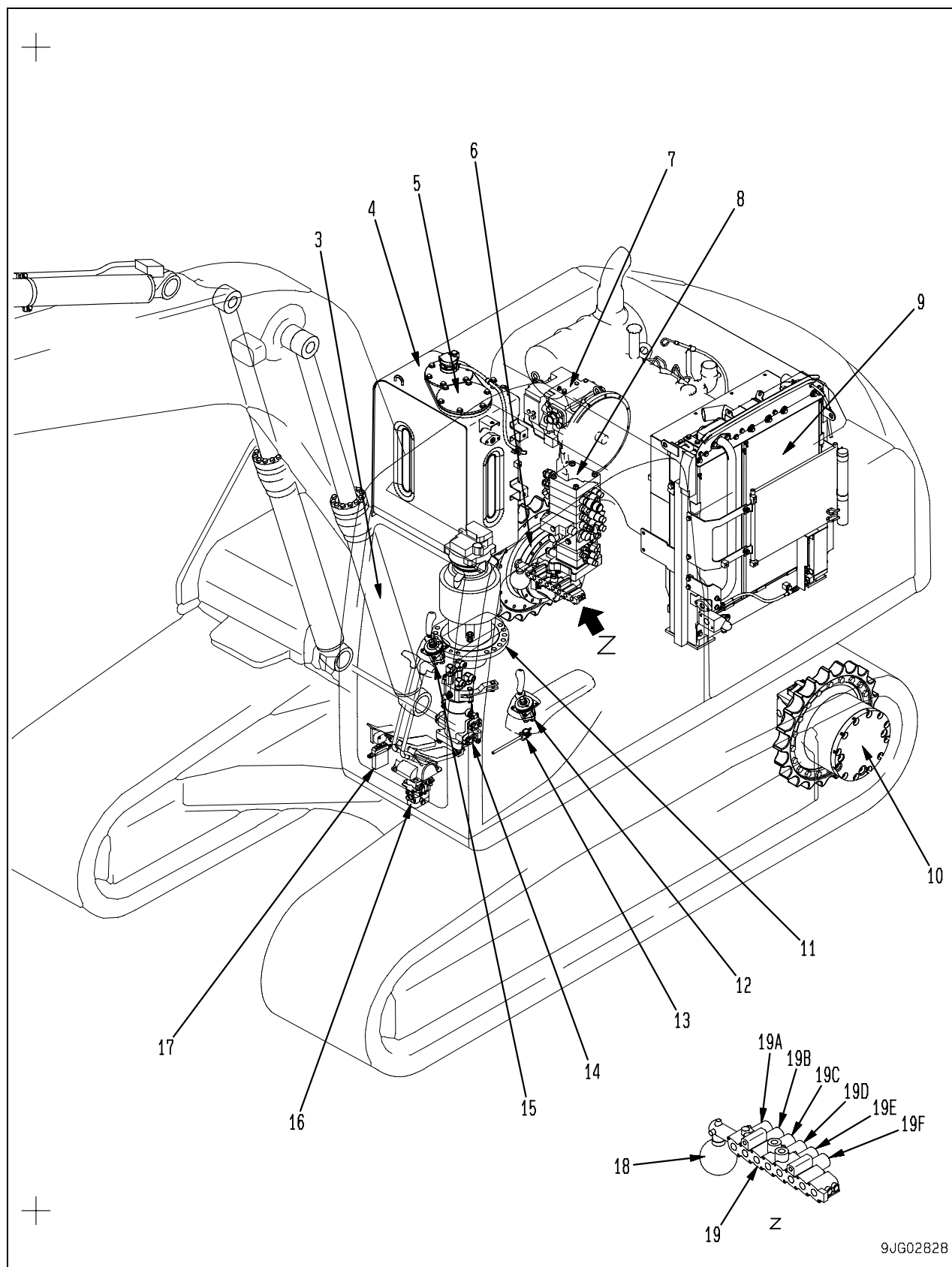
Hydraulic system, Part 1

Hydraulic equipment layout drawing	2
Hydraulic tank	4
Hydraulic pump	6

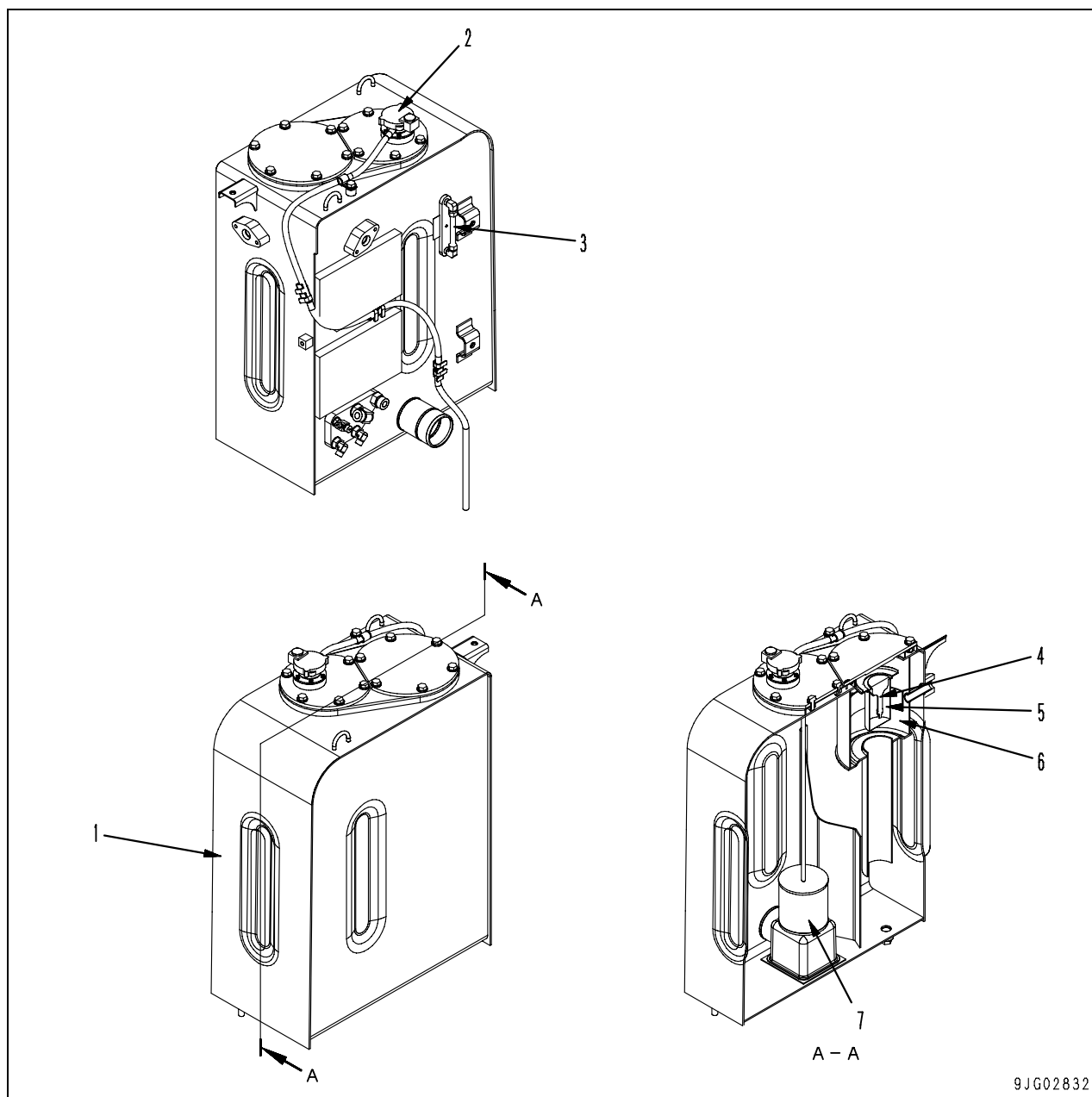
Hydraulic equipment layout drawing

1. Bucket cylinder
2. Arm cylinder
3. Boom cylinder
4. Hydraulic tank
5. Hydraulic oil filter
6. R.H. travel motor
7. Hydraulic pump
8. Control valve
9. Oil cooler
10. L.H. travel motor
11. Swing motor
12. L.H. PPC valve
13. Safety lever (electric type)
14. Centre swivel joint
15. R.H. PPC valve
16. Travel PPC valve
17. Attachment circuit selector valve
18. Accumulator
19. Solenoid valve assembly
 - 19A. PPC lock solenoid valve
 - 19B. Travel junction solenoid valve
 - 19C. Pump merge/divider solenoid valve
 - 19D. Travel speed solenoid valve
 - 19E. Swing holding brake solenoid valve
 - 19F. 2-stage relief solenoid valve





Hydraulic tank



9JG02832

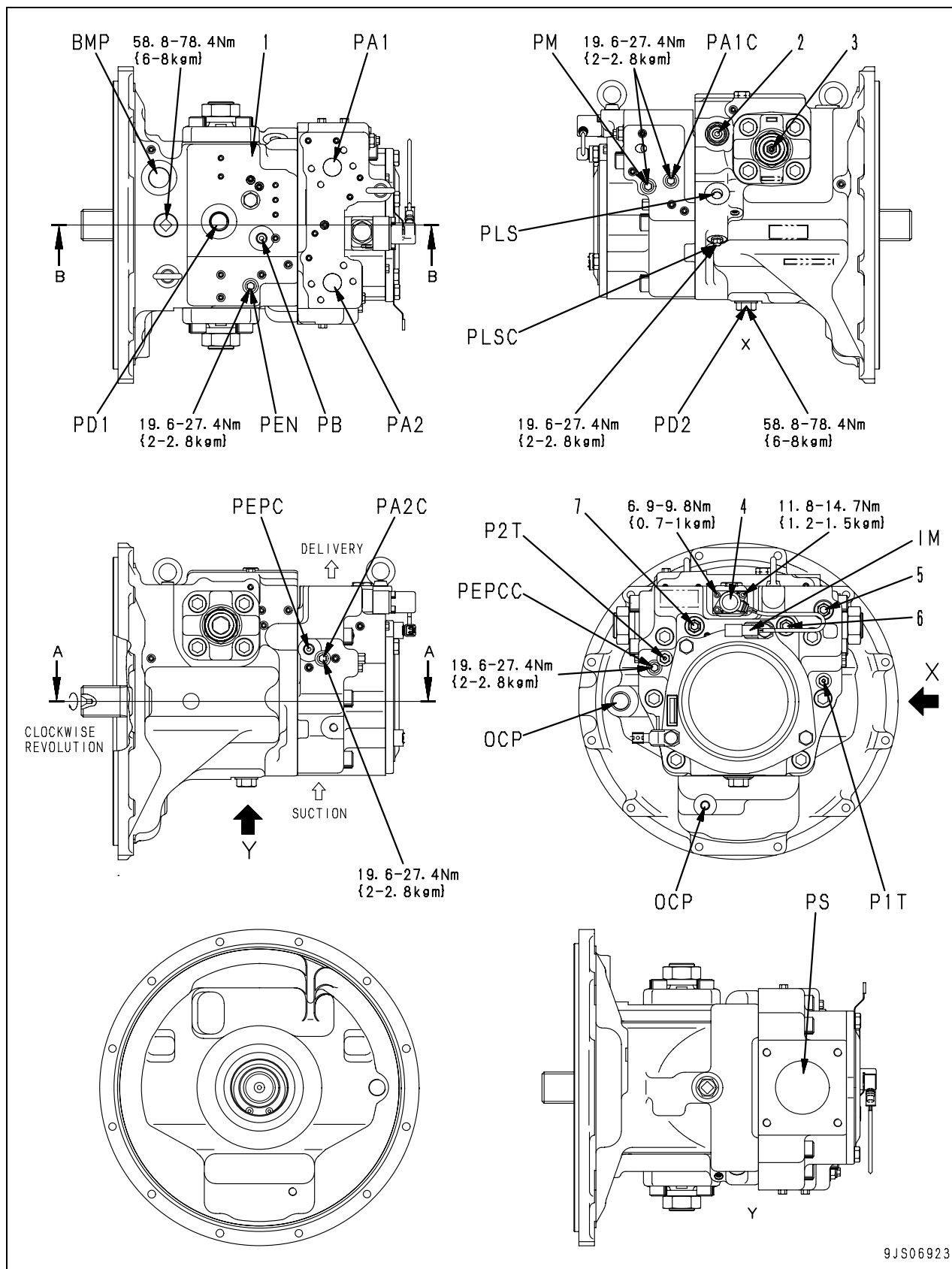
1. Hydraulic tank
2. Oil filler cap
3. Sight gauge
4. Bypass valve
5. Strainer
6. Filter element
7. Suction strainer

Specifications

Tank capacity : 167 ℓ
 Amount of oil inside tank : 121 ℓ
 Pressure valve
 Relief cracking pressure:
 $16.7 \pm 6.9 \text{ kPa}$
 $0.17 \pm 0.07 \text{ kg/cm}^2$
 Suction cracking pressure:
 $0 - 0.49 \text{ kPa}$
 $\{0 - 0.005 \text{ kg/cm}^2\}$
 Bypass valve set pressure:
 $150 \pm 30 \text{ kPa}$
 $\{1.5 \pm 0.3 \text{ kg/cm}^2\}$

Hydraulic pump

Type: HPD71+71

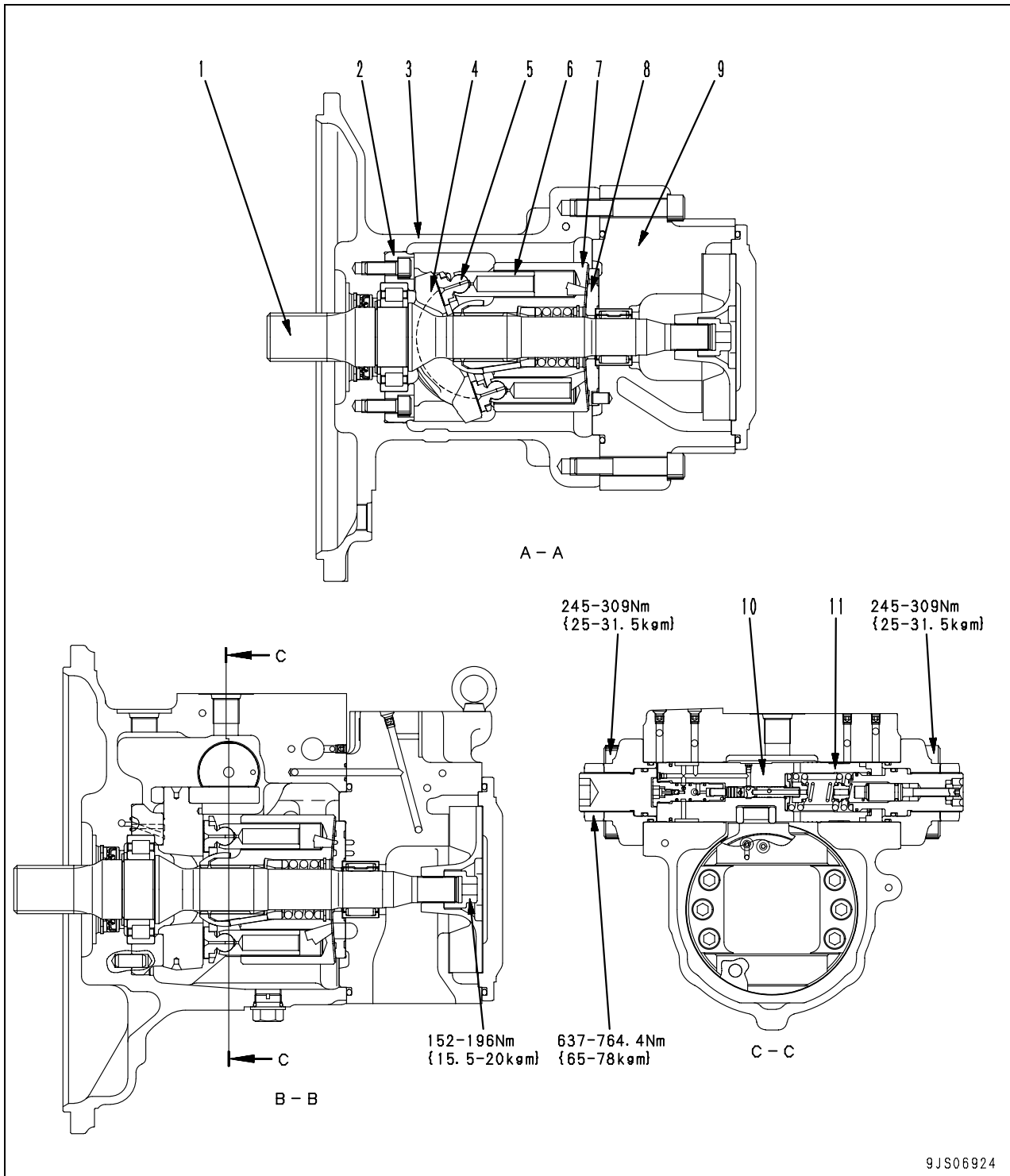


Outline

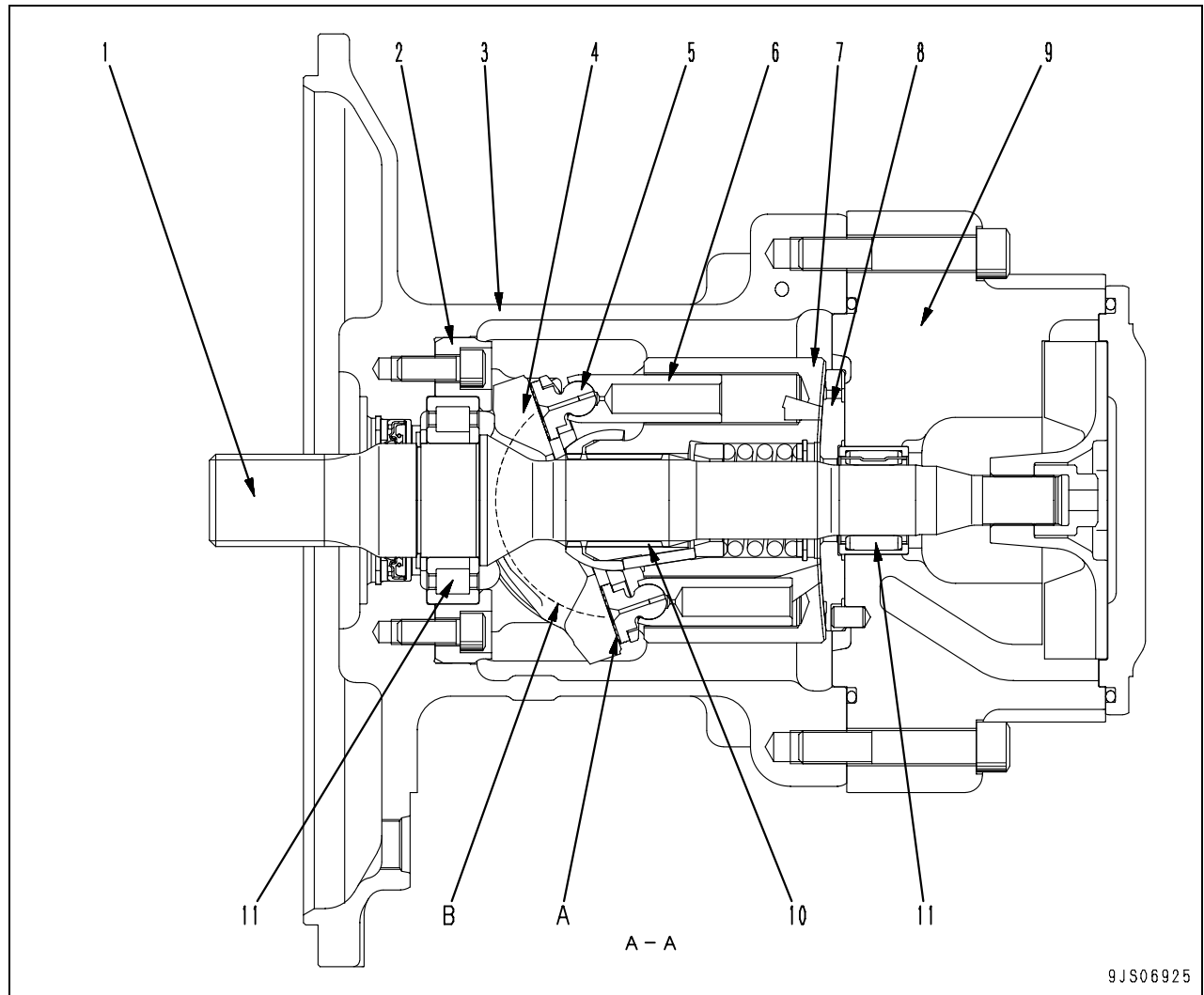
- This pump consists of variable capacity swash plate piston pump, PC valve, LS valve, and EPC valve.

BMP : Breather mounting port
IM : PC mode selector current
OCP : Oil level check port
P1T : Travel deviation adjustment orifice
P2T : Travel deviation adjustment orifice
PA1 : Pump discharge port
PA1C : Pump discharge pressure pick-up port
PA2 : Pump discharge port
PA2C : Pump discharge pressure pick-up port
PB : Pump pressure input port
PD1 : Case drain port
PD2 : Drain plug
PEN : Control pressure pick-up port
PEPC : EPC basic pressure input port
PEPCC: EPC basic pressure pick-up port
PLS : Load pressure input port
PLSC : Load pressure pick-up port
PM : PC mode selector pressure pick-up port
PS : Pump suction port

1. Main pump
2. LS valve
3. PC valve
4. PC-EPC valve
5. Shuttle valve
6. No. 1 check valve
7. No. 2 check valve



- | | |
|---------------|-------------------|
| 1. Shaft | 7. Cylinder block |
| 2. Cradle | 8. Valve plate |
| 3. Case | 9. End cap |
| 4. Rocker cam | 10. Servo piston |
| 5. Shoe | 11. PC valve |
| 6. Piston | |



Function

- The pump converts the engine rotation and torque transmitted to its shaft to oil pressure and delivers pressurized oil corresponding to the load.
- It is possible to change the delivery by changing the swash plate angle.

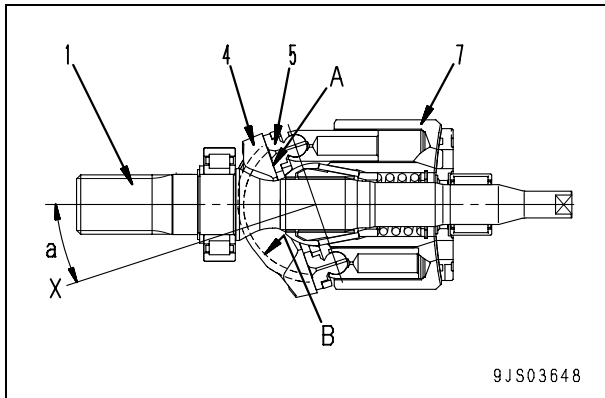
Structure

- Cylinder block (7) is supported to shaft (1) by spline (10).
- Shaft (1) is supported by front and rear bearings (11).
- Tip of piston (6) is shaped as a concave ball and shoe (5) is caulked to it to form one unit.
- Piston (6) and shoe (5) constitute the spherical bearing.
- Rocker cam (4) has flat surface (A), and shoe (5) is always pressed against this surface while sliding in a circular movement.

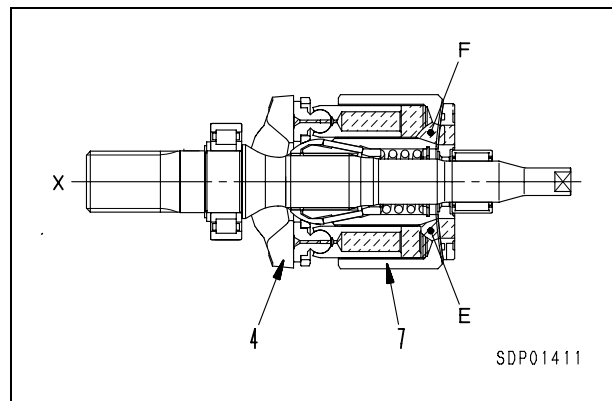
- Rocker cam (4) conducts high pressure oil to the cylinder surface (B) with cradle (2), which is secured to the case, and forms a static pressure bearing when it slides.
- Piston (6) carries out relative movement in the axial direction inside each cylinder chamber of cylinder block (7).
- Cylinder block (7) seals the pressurized oil to valve plate (8) and carries out relative rotation.
- This surface is designed so that the oil pressure balance is maintained at a suitable level.
- The oil inside the respective cylinder chambers of cylinder block (7) is suctioned and discharged through valve plate (8).

Operation of pump

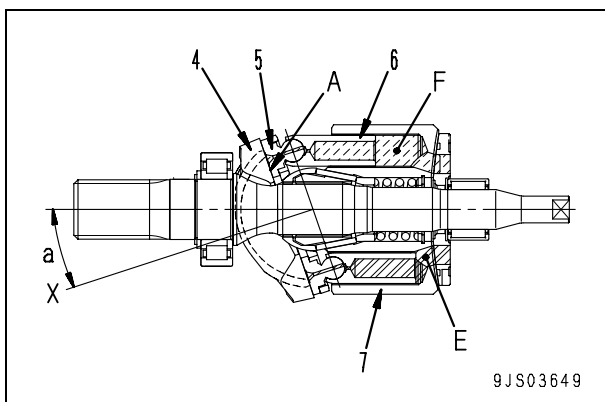
- Cylinder block (7) rotates together with shaft (1), and shoe (5) slides on flat surface (A).
- When this happens, rocker cam (4) moves along cylindrical surface (B), so angle (a) between centre line (X) of rocker cam (4) and the axial direction of cylinder block (7) changes.
- (a) is named the swash plate angle.



- As centre line (X) of rocker cam (4) matches the axial direction of cylinder block (7) (swash plate angle (a) = 0), the difference between volumes (E) and (F) inside cylinder block (7) becomes 0.
- Suction and discharge of pressurized oil is not carried out in this state. Namely pumping action is not performed. (Actually, however, the swash plate angle is not set to 0)

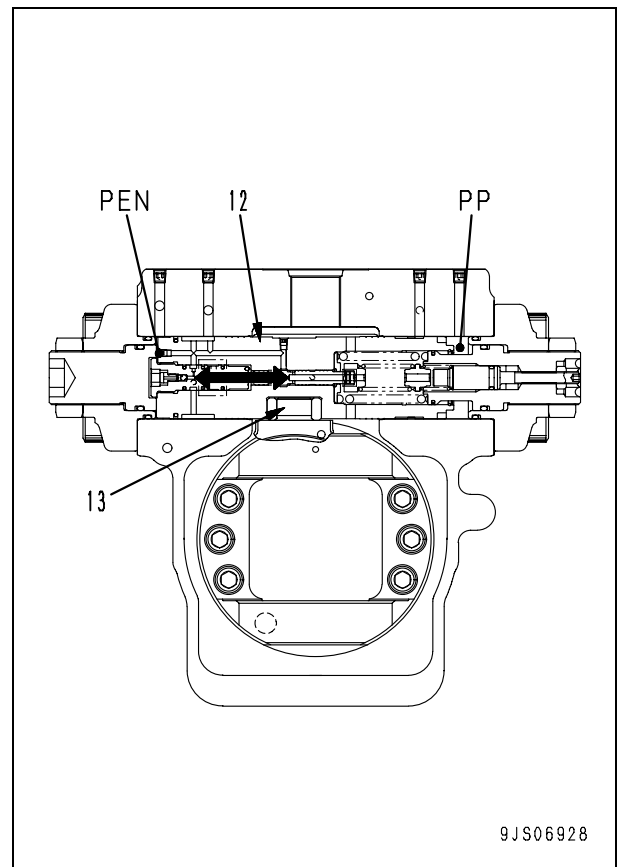
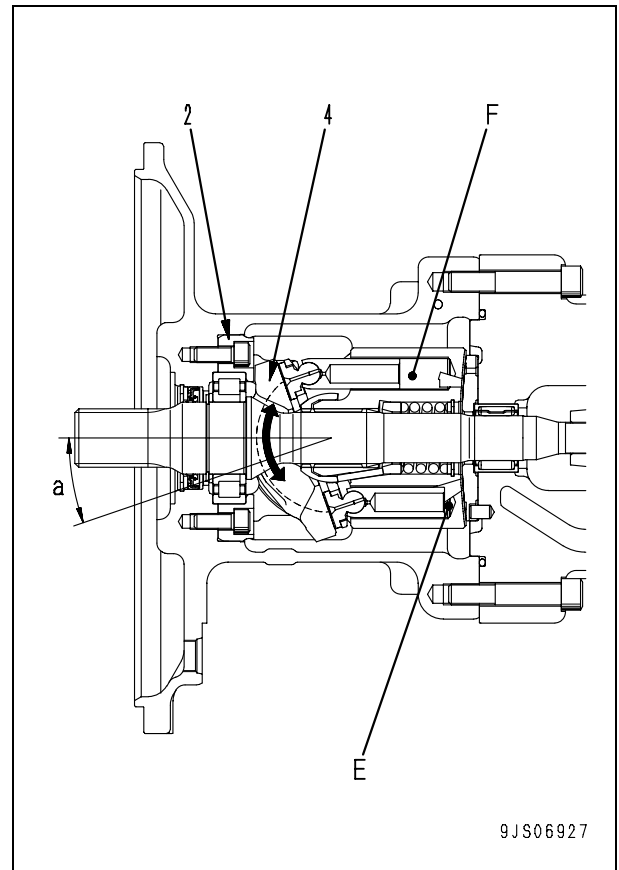


- With centre line (X) of rocker cam (4) at a swash plate angle (a) in relation to the axial direction of cylinder block (7), flat surface (A) acts as a cam in relation to shoe (5).
- In this way, piston (6) slides on the inside of cylinder block (7), so a difference between volumes (E) and (F) is created inside cylinder block (7).
- A single piston suction and discharges the oil by the amount (F) – (E).
- As cylinder block (7) rotates and the volume of chamber (E) becomes smaller, the pressurized oil is discharged.
- On the other hand, the volume of chamber (F) grows larger and, in this process, the oil is suctioned.

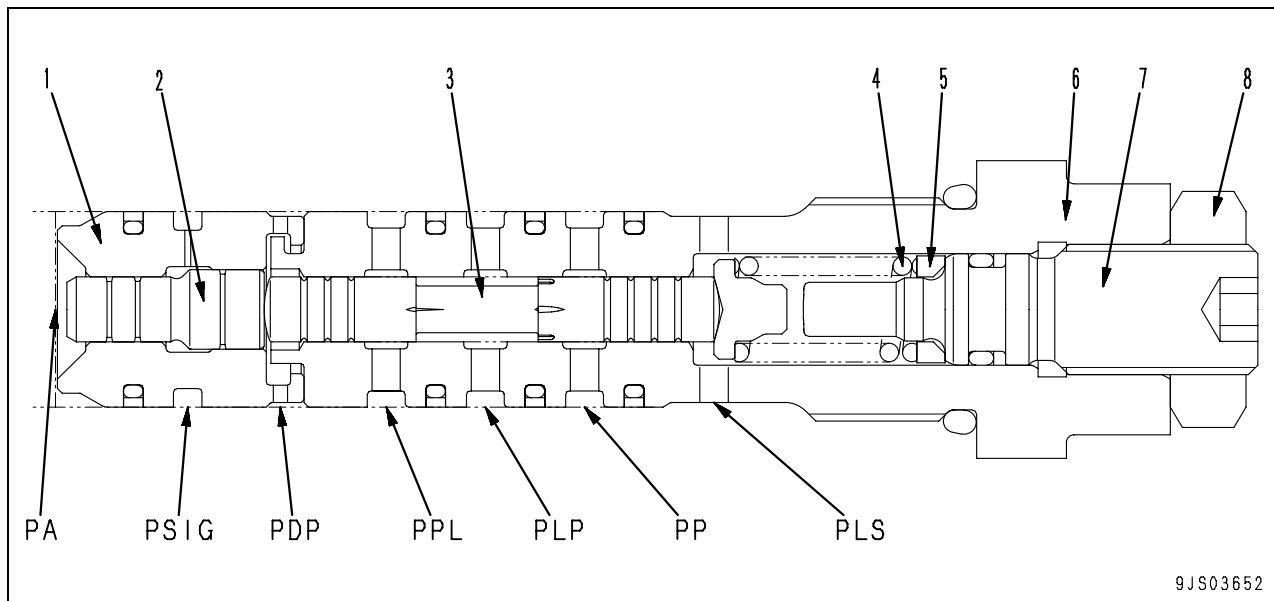


Control of delivery

- If the swash plate angle (a) becomes larger, the difference between volumes (E) and (F) becomes larger and pump delivery (Q) increases.
- Servo piston (12) is used for changing swash plate angle (a).
- Servo piston (12) carries out linear reciprocal movement according to the signal pressure from the PC and LS valves.
- This linear movement is transmitted to rocker cam (4) via slider (13).
- Being supported by cradle (2) on the cylindrical surface, rocker cam (4) slides on the surface while continuing revolving movement.
- Space of the pressure receiving area of servo piston (12) are not identical on the left side and right side. Main pump discharge pressure (check valve output pressure) (PP) is always brought to the pressure chamber of the small diameter piston side.
- Output pressure (PEN) of the LS valve is brought to the chamber receiving the pressure at the large diameter piston end.
- The relationship in the size of pressure (PP) at the small diameter piston end and pressure (PEN) at the large diameter piston end, and the ratio between the area receiving the pressure of the small diameter piston and the large diameter piston controls the movement of servo piston (12).



LS valve



PA : Pump port

PDP : Drain port

PLP : LS control pressure output port

PLS : LS pressure input port

PP : Pump port

PPL : Control pressure input port

PSIG : Drain port

1. Sleeve

2. Piston

3. Spool

4. Spring

5. Sheet

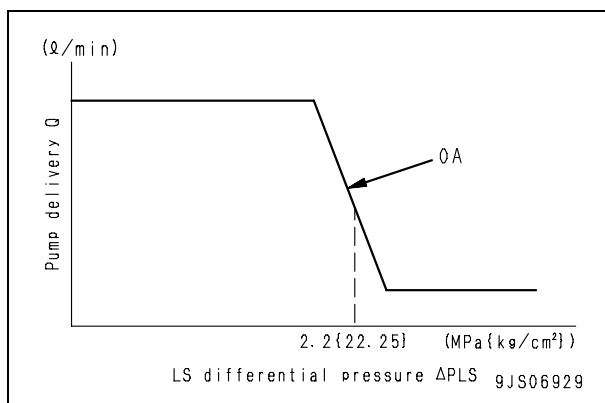
6. Sleeve

7. Plug

8. Locknut

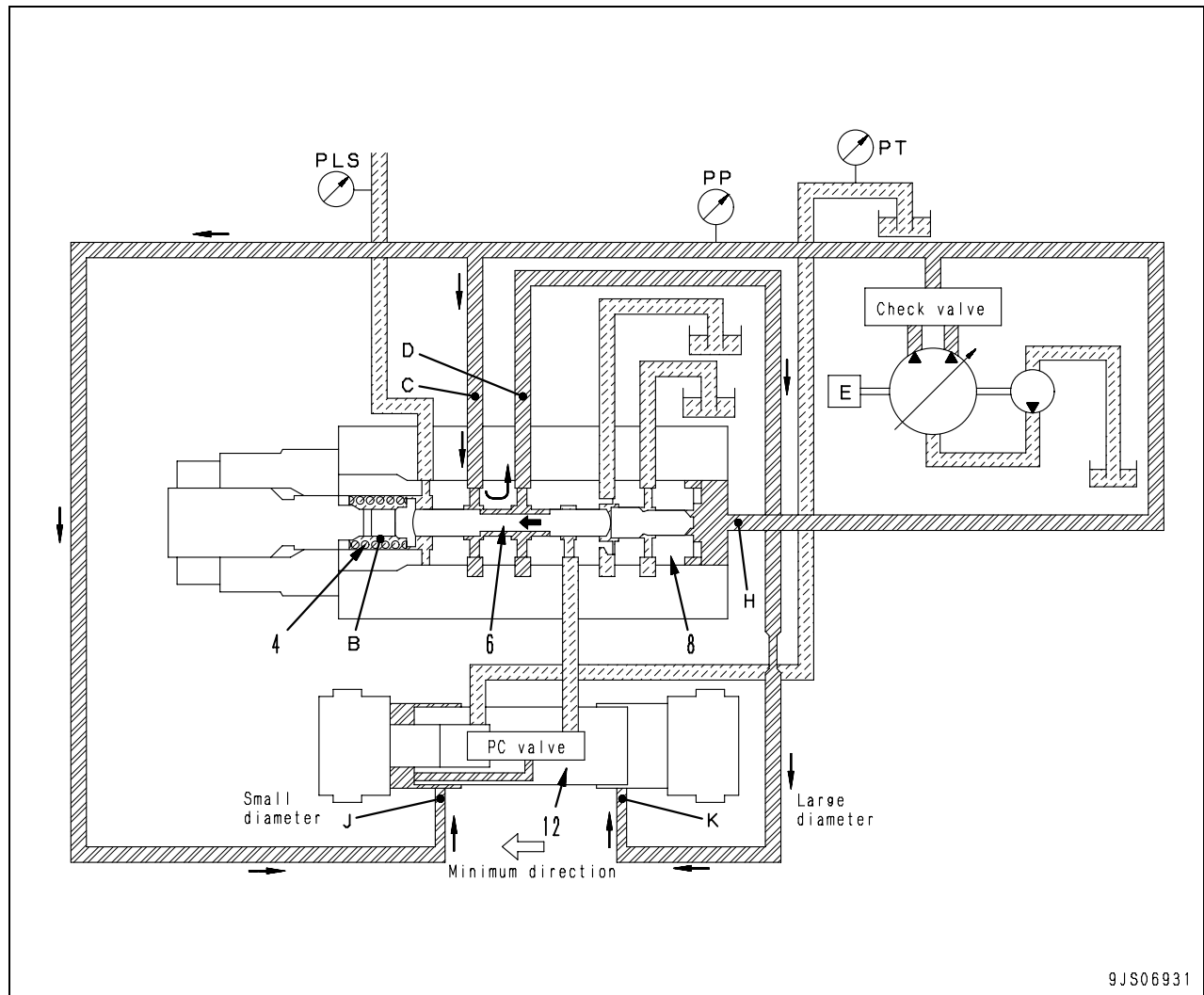
Function

- The LS (load sensing) valve detects the load and controls the delivery.
- This valve controls main pump delivery (Q) according to differential pressure (ΔPLS) [= (PP) — (PLS)], called the LS differential pressure (the difference between main pump pressure (PP) and control valve outlet port pressure (PLS)).
- Main pump pressure (PP), pressure (PLS) (called the LS pressure) coming from the control valve output.

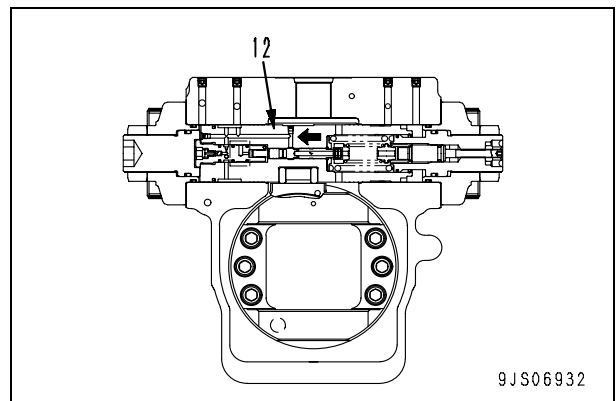


Operation

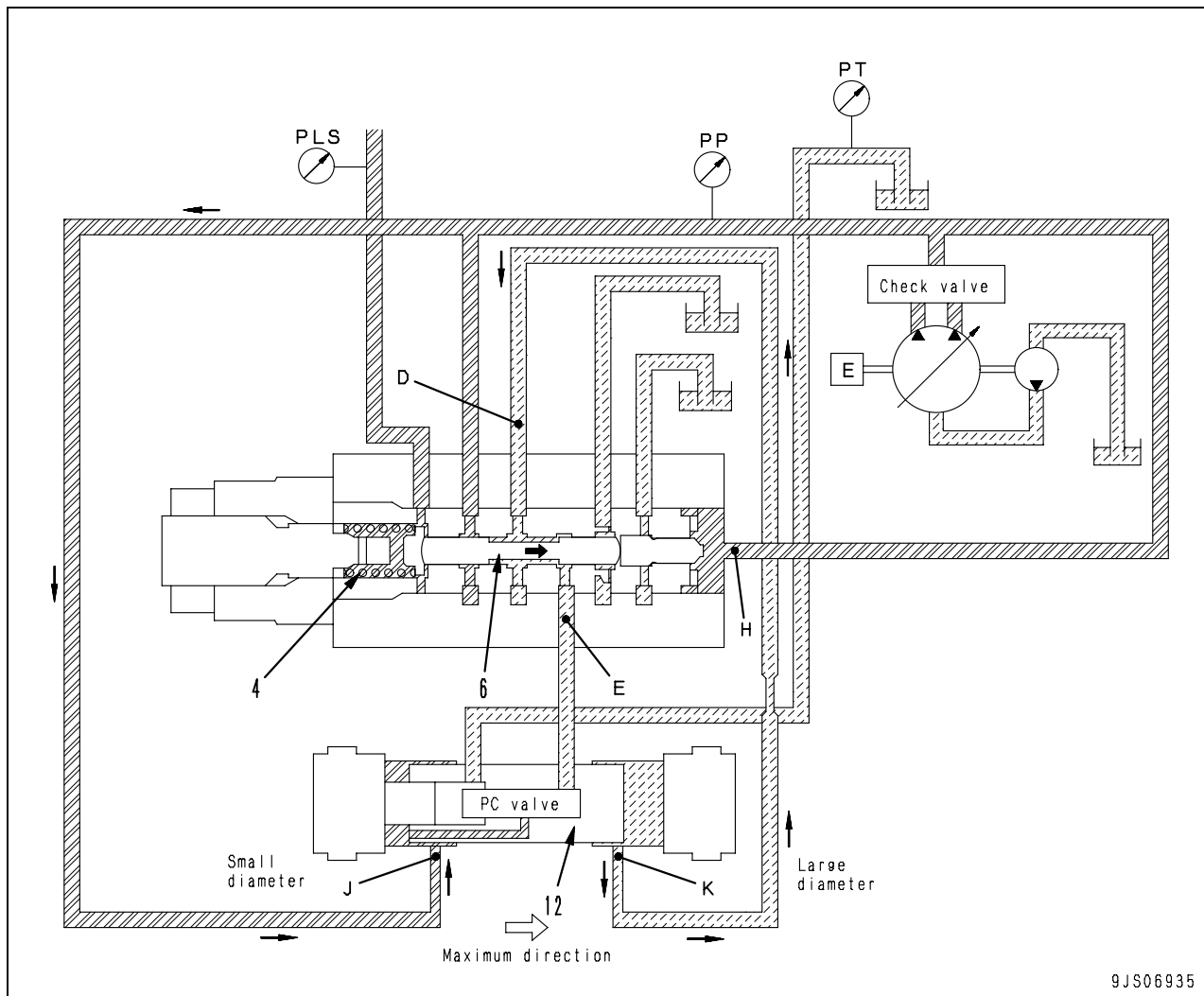
1. When the control valve is situated at neutral



- The LS valve is a 3-way selector valve, with pressure (PLS) (LS pressure) from the outlet port of the control valve brought to spring chamber (B), and main pump discharge pressure (PP) brought to port (H) of sleeve (8).
- Magnitude of the force resulting from this LS pressure (PLS), force of spring (4) and the pump delivery pressure (check valve output pressure) (PP) determine the position of spool (6).
- Before the engine is started, servo piston (12) is pushed to the left. (See the diagram on the right)
- If the control lever is at the neutral position when the engine is started, LS pressure (PLS) will be set to 0 MPa {0 kg/cm²}. (It is interconnected to the drain circuit via the control valve spool)
- Spool (6) is pushed to the left, and port (C) and port (D) will be connected.
- Pump pressure (PP) is conducted to the larger diameter end from the port (K).
- The same pump pressure (PP) is conducted to the smaller diameter end from the port (J).
- According to the difference in the areas on servo piston (12), the pressure moves in such that the swash plate angle may be minimized.



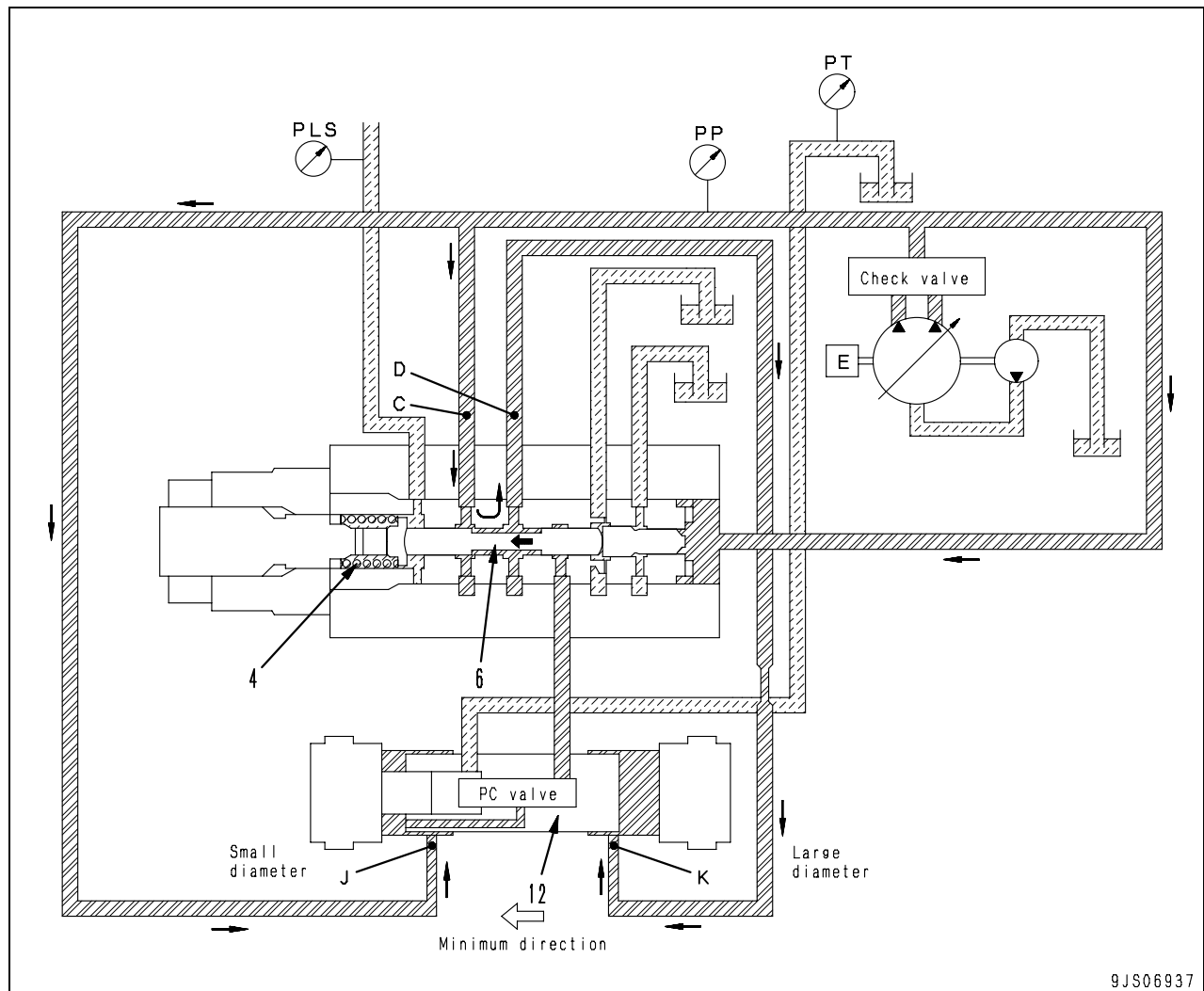
2. Action for the direction of maximizing the pump delivery



9JS06935

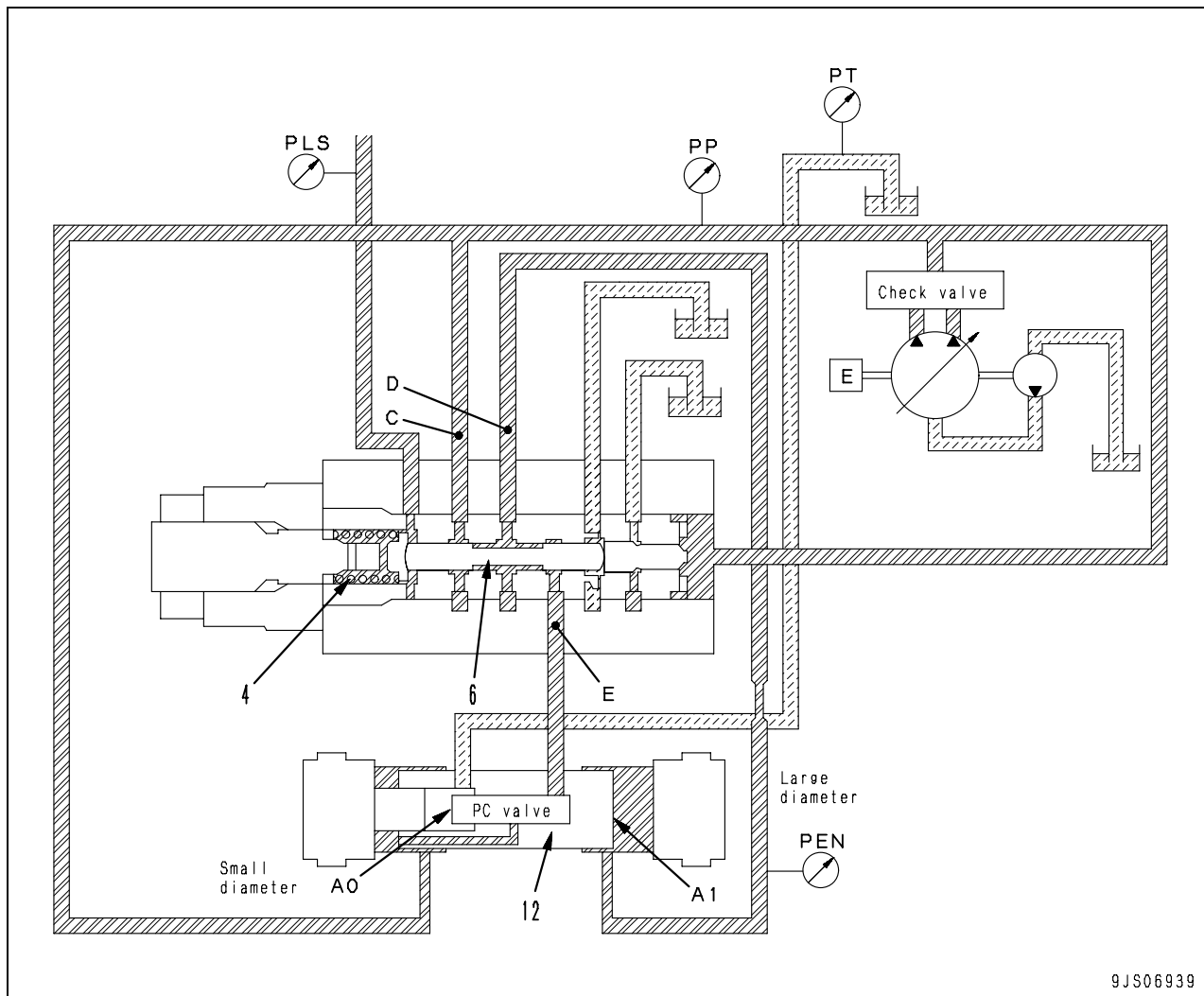
- When the difference between the main pump pressure (PP) and LS pressure (PLS), in other words, LS differential pressure (ΔPLS) becomes smaller [for example, when the area of opening of the control valve becomes larger and pump pressure (PP) drops], spool (6) is pushed to the right by the combined force of LS pressure (PLS) and the force of spring (4).
- When spool (6) moves, port (D) and port (E) are interconnected and connected to the PC valve.
- The PC valve is connected to the drain port, so the pressure across circuits (D) and (K) becomes drain pressure (PT). (The operation of the PC valve is explained later.)
- The pressure at the large diameter end of servo piston (12) becomes drain pressure (PT), and pump pressure (PP) enters port (J) at the small diameter end, so servo piston (12) is pushed to the right side. Therefore, the swash plate is moved in the direction to make the delivery larger.

3. Action for the direction of minimizing the pump delivery



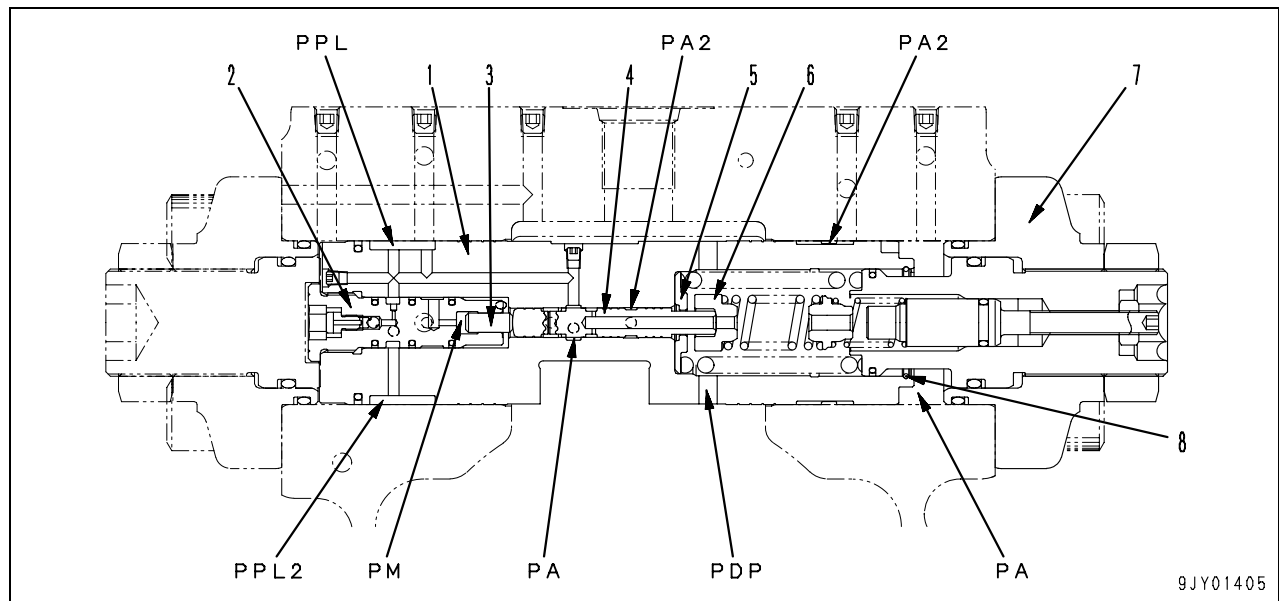
- When LS differential pressure (ΔPLS) becomes larger [for example, when the area of opening of the control valve becomes smaller and pump pressure (PP) rises] because of the leftward move (it reduces delivery) of servo piston (12), pump pressure (PP) pushes spool (6) to the left.
- When spool (6) moves, main pump pressure (PP) flows from port (C) to port (D) and from port (K), it enters the large diameter end of the piston.
- Main pump pressure (PP) also enters port (J) of the small diameter end of the piston, but because of the difference in area between the large diameter end and the small diameter end on servo piston (12), it is pushed to the left. As the result, the servo piston (12) moves into the direction of reducing the swash plate angle.

4. When servo piston is balanced



- Let us take the area receiving the pressure at the large diameter end of the piston as (A1), the area receiving the pressure at the small diameter end as (A0), and the pressure flowing into the large diameter end of the piston as (PEN).
- If the main pump pressure (PP) of the LS valve and the combined force of spring (4) and LS pressure (PLS) are balanced, and the relationship is $(A0) \times (PP) = (A1) \times (PEN)$, servo piston (12) will stop in that position.
- The swash plate of the pump will be held at the intermediate position. [Spool (6) will be stopped at a position where the distance of the opening from port (D) to port (E) and the distance from port (C) to port (D) is almost the same.]
- At this point, the relationship between the pressure receiving areas across servo piston (12) is $(A0) : (A1) = 1 : 2$, so the pressure applied across the piston when it is balanced becomes $(PP) : (PEN) \approx 2 : 1$.
- Force of spring (4) is adjusted in such that the position of the balanced stop of this spool (6) may be determined when $(PP) - (PLS) = 2.2 \text{ MPa } \{22.25 \text{ kg/cm}^2\}$ at the median of the specified value.

PC valve



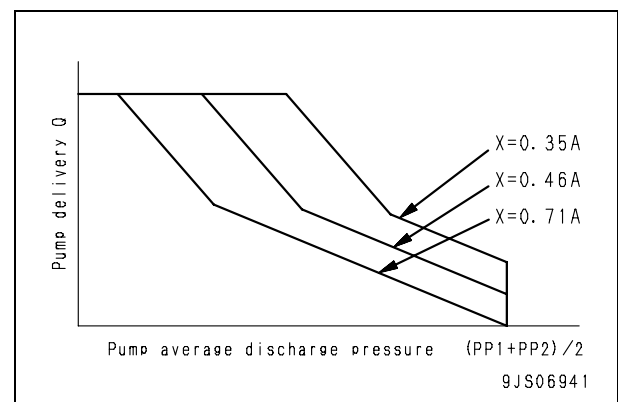
PA : Pump port
 PA2 : Pump pressure pilot port
 PDP : Drain port
 PM : Mode selector pressure pilot port
 PPL : PC control pressure output port
 PPL2: LC control pressure output port

1. Plug
2. Servo piston assembly
3. Pin
4. Spool
5. Retainer
6. Sheet
7. Cover
8. Wiring

Function

- When the pump discharge pressure (PP1) (check valve output pressure) and (PP2) (shuttle valve output pressure) are high, the PC valve controls the pump so that the volume of oil beyond the discharge pressure-based specific flowrate may not be conducted however you may increase the control valve stroke. Namely it is intended at controlling the horse power for the pumps so that it may not exceed the engine hose power.
- If the pump discharge pressure (PP1) increases due to increased load during operation, this valve decreases the pump delivery.
- And if the pump delivery pressure goes low, it increases the pump delivery.
- In this case, relation between the mean average discharge pressure of the pump $[(PP1) + (PP2)]/2$ and the pump delivery (Q) will becomes as shown in the diagram if the relation is represented as the parameter the current value to be given to PC-EPC valve solenoid.
- The controller continues counting the actual engine speed.

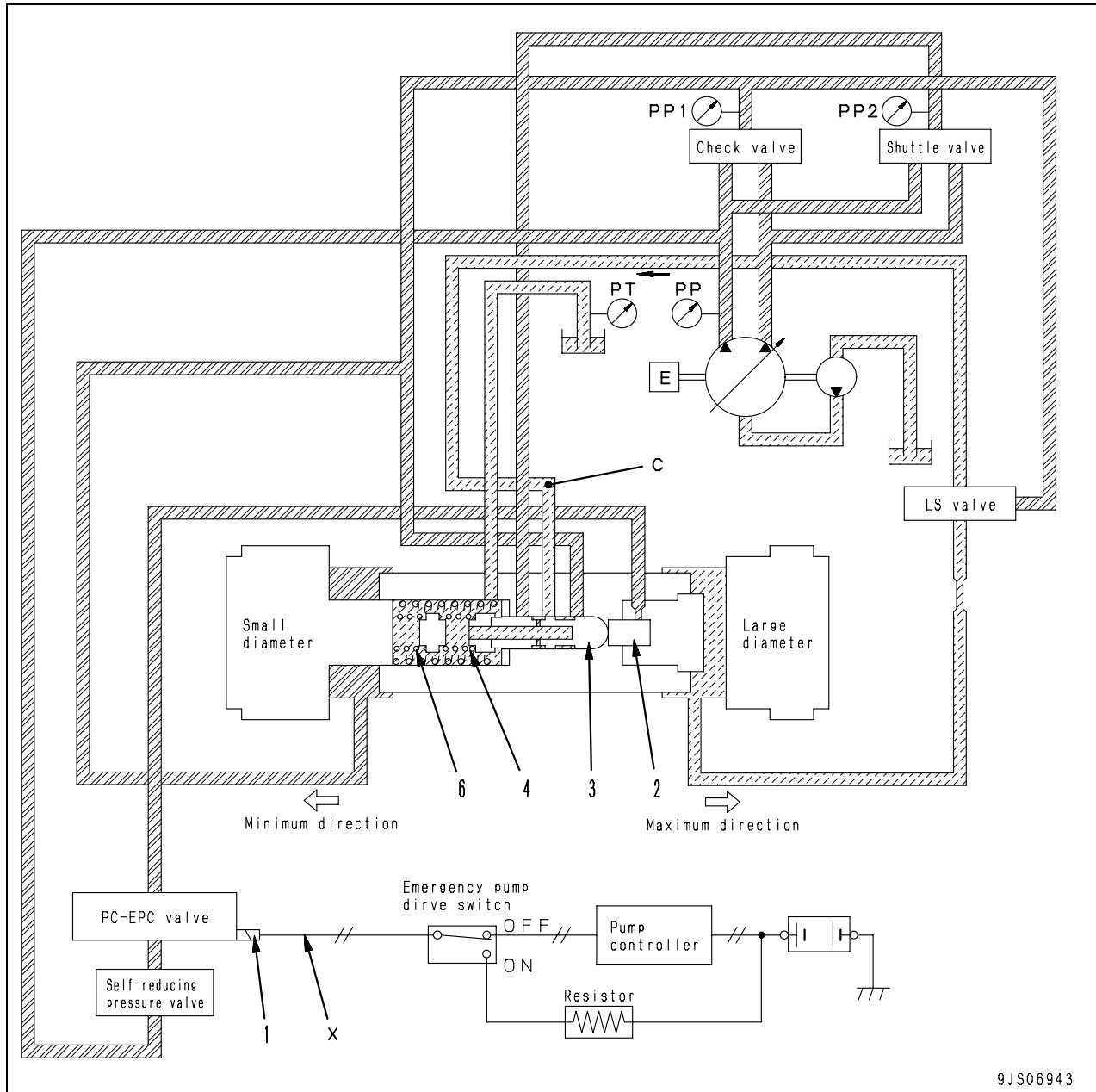
- If the engine speed is slowed down due to increased load, the controller reduces the pump delivery to recover the speed.
- If the engine speed goes below the specified value because of increased load, the controller sends a command current to PC-EPC valve solenoid in order to reduce the slope angle in proportion to reduction in the engine speed.



Operation

1. When pump controller is normal

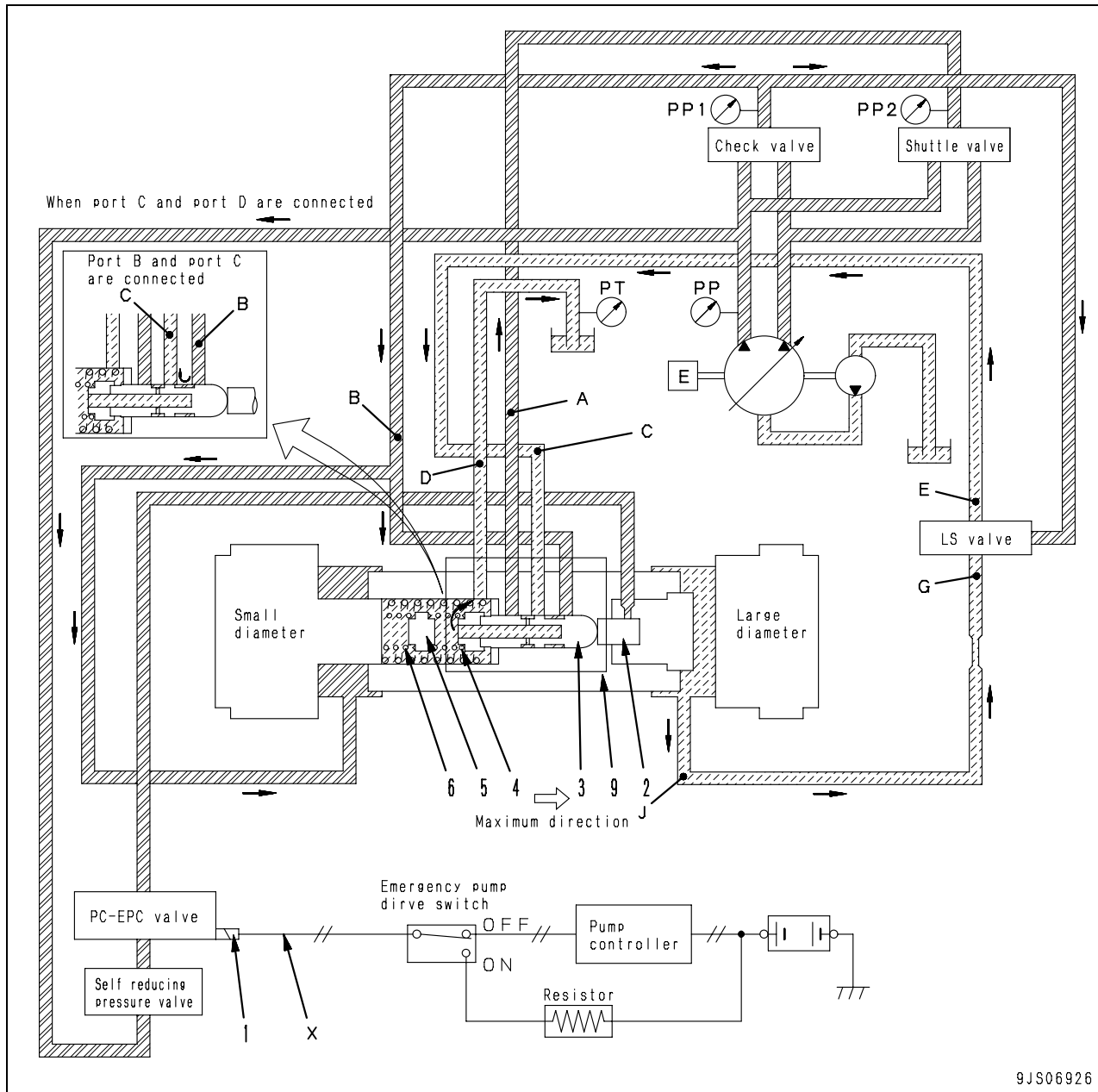
1) When the load on the actuator is small and pump discharge pressures (PP1) and (PP2) are low



9JS06943

Action of PC-EPC valve solenoid (1)

- Command current (X) is being sent to PC-EPC valve solenoid (1) from the pump controller.
- This command current acts on PC-EPC valve to output the signal pressure in order to modify the force pushing piston (2).
- Spool (3) stops at a position where the combined spool-pushing force is balanced by the setting force of springs (4) and (6) as well as the pump pressures (PP1) (check valve output pressure) and (PP2) (shuttle valve output pressure).
- The pressure [port (C) pressure] output from PC valve is changed depending on the above position.
- The size of command current (X) is determined by the nature of the operation (lever operation), the selected working mode, and the set value and actual value of the engine speed.

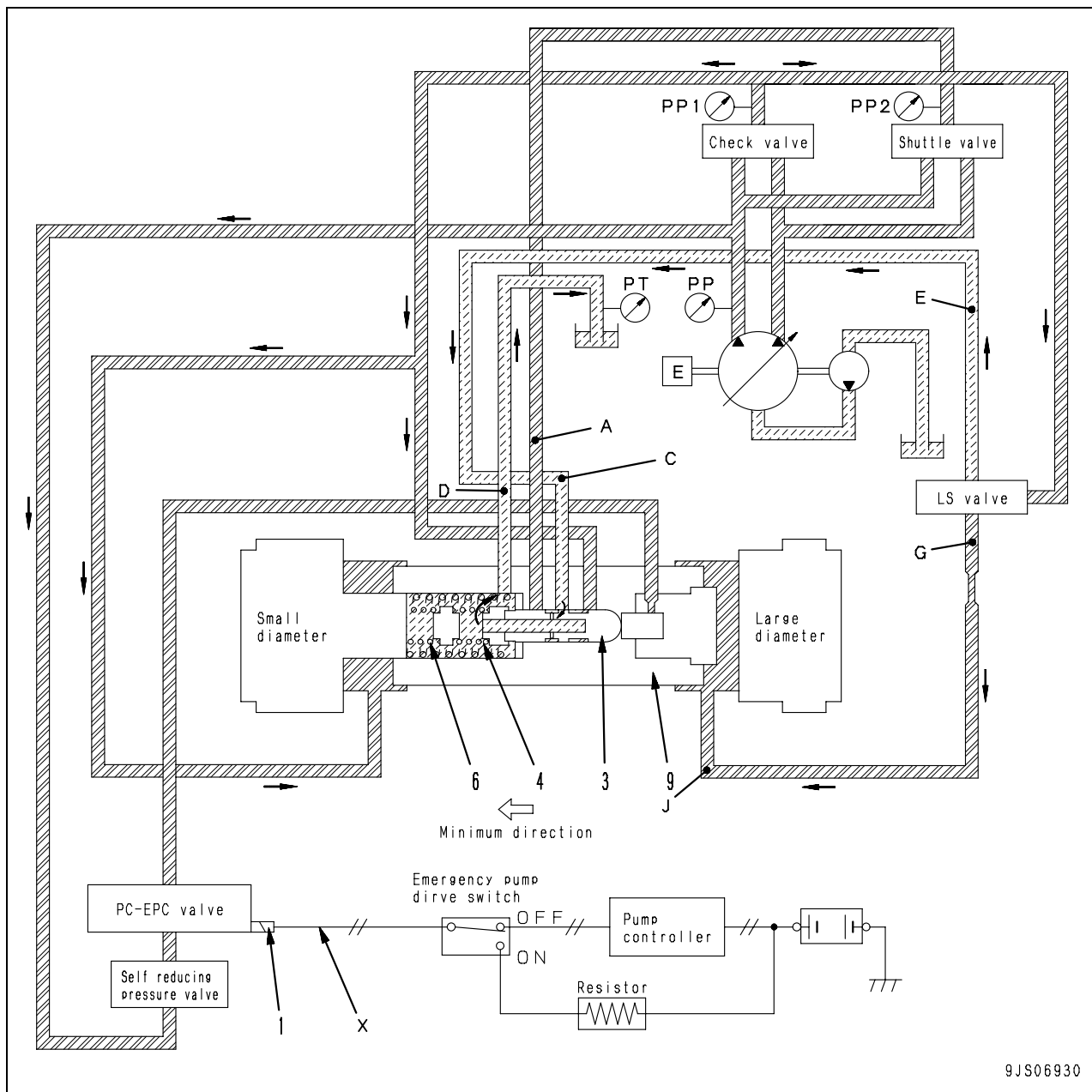


Action of spring

- Load of springs (4) and (6) on the PC valve is determined by the swash plate position.
- As servo piston (9) moves to left, spring (6) is retracted.
- If the servo piston moves further, it will be contacted again seat (5) and spring (6) will be fixed.
- After that, spring (4) alone will operate.
- The spring load is changed by servo piston (9) as it extends or compresses springs (4) and (6).
The spring load changes as the servo piston (9) extends and contracts the springs (4) and (6).
- If the command current (X) to PC-EPC valve solenoid (1) changes, so does the force pushing piston (2).
- Spring load of springs (4) and (6) is also affected by the command current (X) to PC-EPC valve solenoid.
- Port (C) of the PC valve is connected to port (E) of the LS valve.
- Check valve output pressure (PP1) enters port (B) and the small diameter end of servo piston (9), and shuttle valve output pressure (PP2) enters port (A).
- When pump pressures (PP1) and (PP2) are small, spool (3) will be positioned in the right side.

- Port (C) and (D) are connected, and the pressure entering the LS valve becomes drain pressure (PT).
- If port (E) and port (G) of the LS valve are connected, the pressure entering the large diameter end of the piston from port (J) becomes drain pressure (PT), and servo piston (9) moves to the right side.
- The pump delivery will be set to the increasing trend.
- Accompanied with move of servo piston (9), springs (4) and (6) will be expanded and the spring force becomes weaker.
- As the spring force is weakened, spool (3) moves to the left, the connecting between port (C) and port (D) is shut off and the pump discharge pressure ports (B) and (C) are connected.
- As a result, the pressure on port (C) rises and the pressure on the large diameter end of the piston also rises. Thus, the rightward move of servo piston (9) is stopped.
- Servo piston (9) stop position (= Pump delivery) is decided by the position where the pushing force generated from the pressures (PP1) and (PP2) applied to spool (3), the pushing force of the solenoid in PC-EPC valve generates and the pushing force of springs (4) and (6) are balanced.

2) When load on actuator is large and pump discharge pressure is high



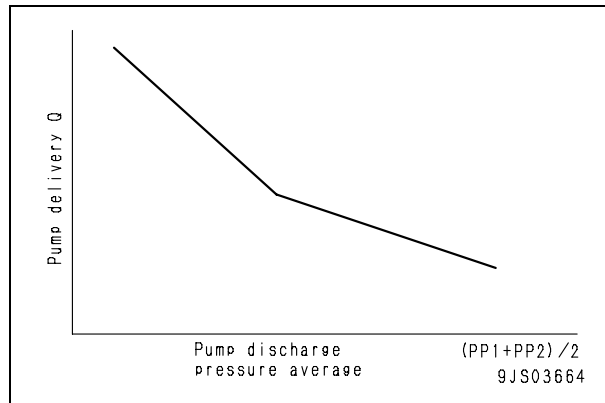
Outline

- When the load is large and pump discharge pressures (PP1) and (PP2) are high, the force pushing spool (3) to the left becomes larger and spool (3) will be moved to the position shown in above figure.
- Part of the pressure to be conducted from port (C) to LS valve flows from port (A) to port (C) and (D) through LS valve. At the end this flow, level of this pressure becomes approximately half of the main pump pressure (PP).

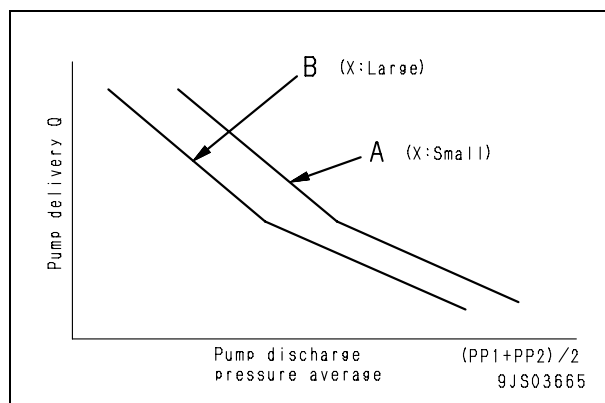
Operation

- When port (E) and port (G) of the LS valve are connected, this pressure from port (J) enters the large diameter end of servo piston (9), stopping servo piston (9).
- If main pump pressure (PP) increases further and spool (3) moves further to the left, main pump pressure (PP1) flows to port (C) and acts to make the pump delivery the minimum.
- When servo piston (9) moves to the left, springs (4) and (6) are compressed and push back spool (3).
- When spool (3) moves to the right, the opening of port (C) and port (D) becomes larger.
- As a result, the pressure on port (C) (= J) is decreased and the rightward move servo piston (9) is stopped.
- The position in which servo piston (9) stops at this time is further to the left than the position when pump pressures (PP1) and (PP2) are low.

- The relationship between the average pump pressure $(PP1 + PP2)/2$ and servo piston (9) in terms of their positions can be represented by the broken line in the figure springs (4) and (6) form the double springs.
- The relationship between the average pump pressure $(PP1 + PP2)/2$ and average pump delivery (Q) becomes as shown below.

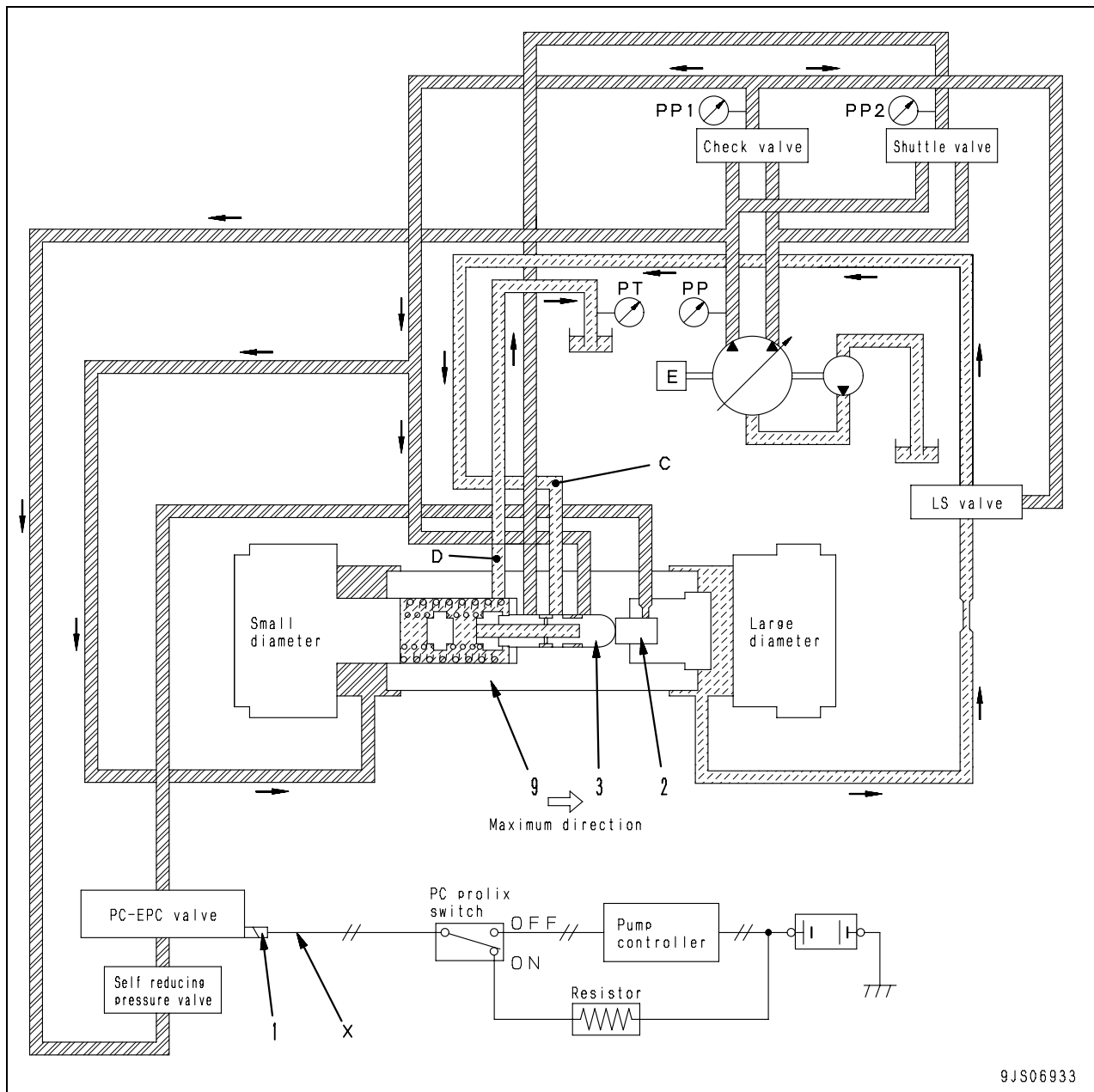


- If command voltage (X) sent to PC-EPC valve solenoid (1) increases further, the relationship between average pump pressure $(PP1 + PP2)/2$, and pump delivery (Q) is proportional to the force of the PC-EPC valve solenoid and moves in parallel.
- Namely, the force of PC-EPC valve solenoid (1) is added to the pushing force to the left because of the pump pressure applied to the spool (3), so the relationship between the average pump pressure $(PP1 + PP2)/2$ and the pump delivery (Q) moves from (A) to (B) as the command current (X) is increased.



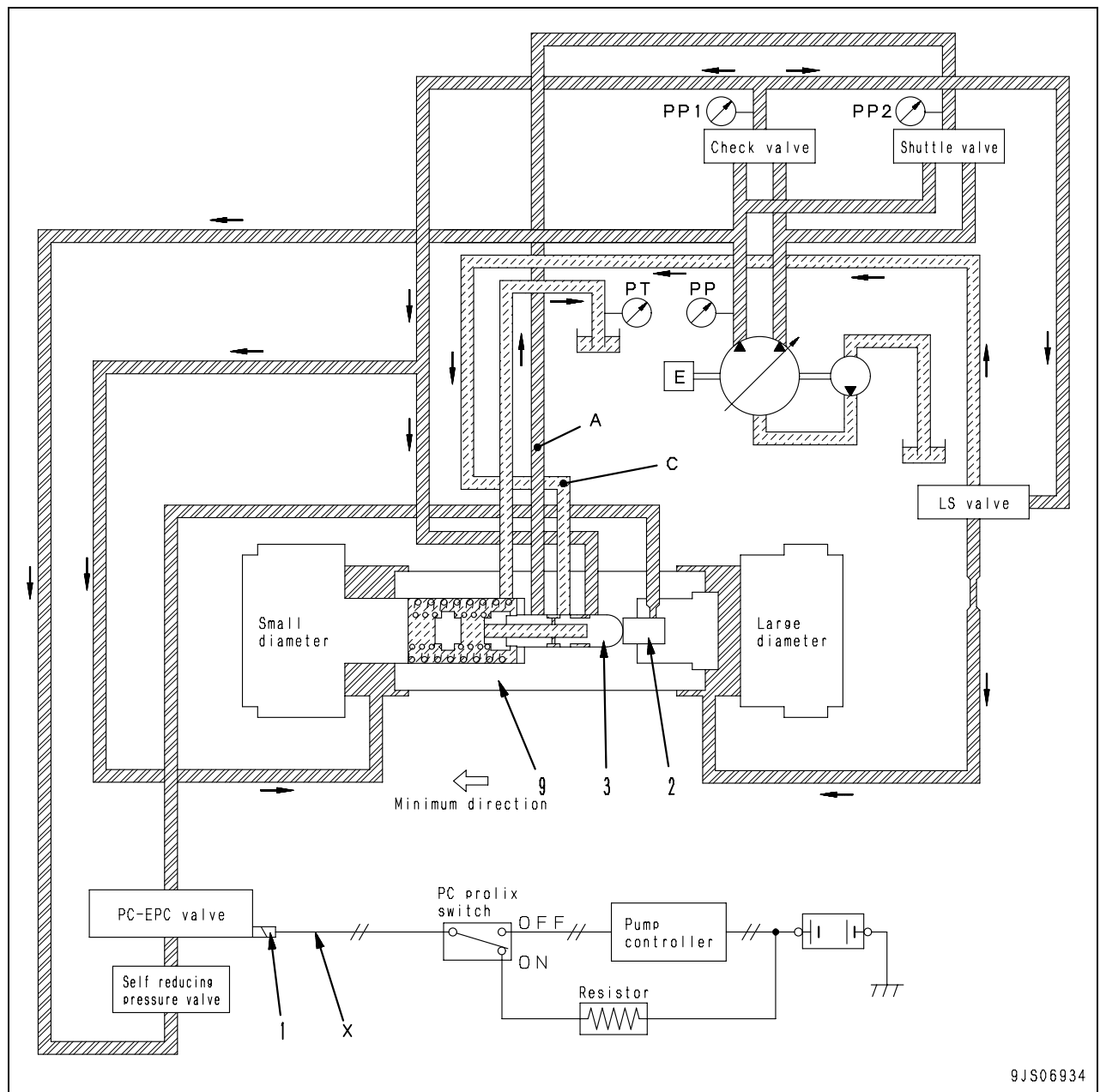
2. As the emergency pump drive switch is turned on due to failure on the pump controller

1) When the main pump is under light load



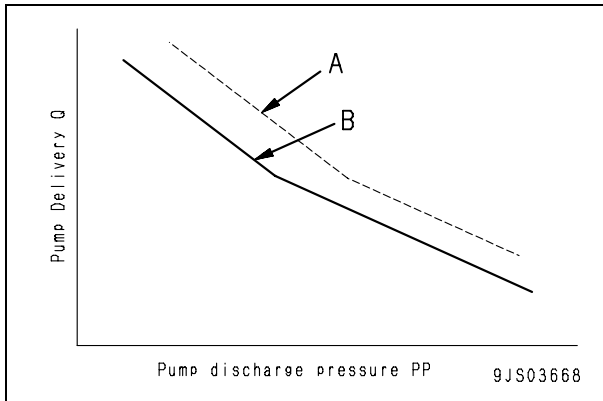
- If there is a failure in the pump controller, the emergency pump drive switch is turned on to hand the control to the resistor side.
- In this case, the power is directly supplied from the battery. The current, however, is too large as is, so the resistor is set in between to control the current flowing to PC-EPC valve solenoid (1).
- The current becomes constant, so the force pushing piston (2) is also constant.
- If the main pump pressures (PP1) and (PP2) are low, the combined force of the pump pressure and the PC-EPC valve solenoid (1) is weaker than the spring set force, so spool (3) is balanced at a position to the right.
- The port (C) is connected to the drain pressure of the port (D), and the large diameter end of the servo piston (9) also becomes the drain pressure (PT) through the LS valve.
- Since the pressure on the small diameter end of the piston large, servo piston (9) moves in the direction to make the delivery larger.

2) When the main pump is under heavy load

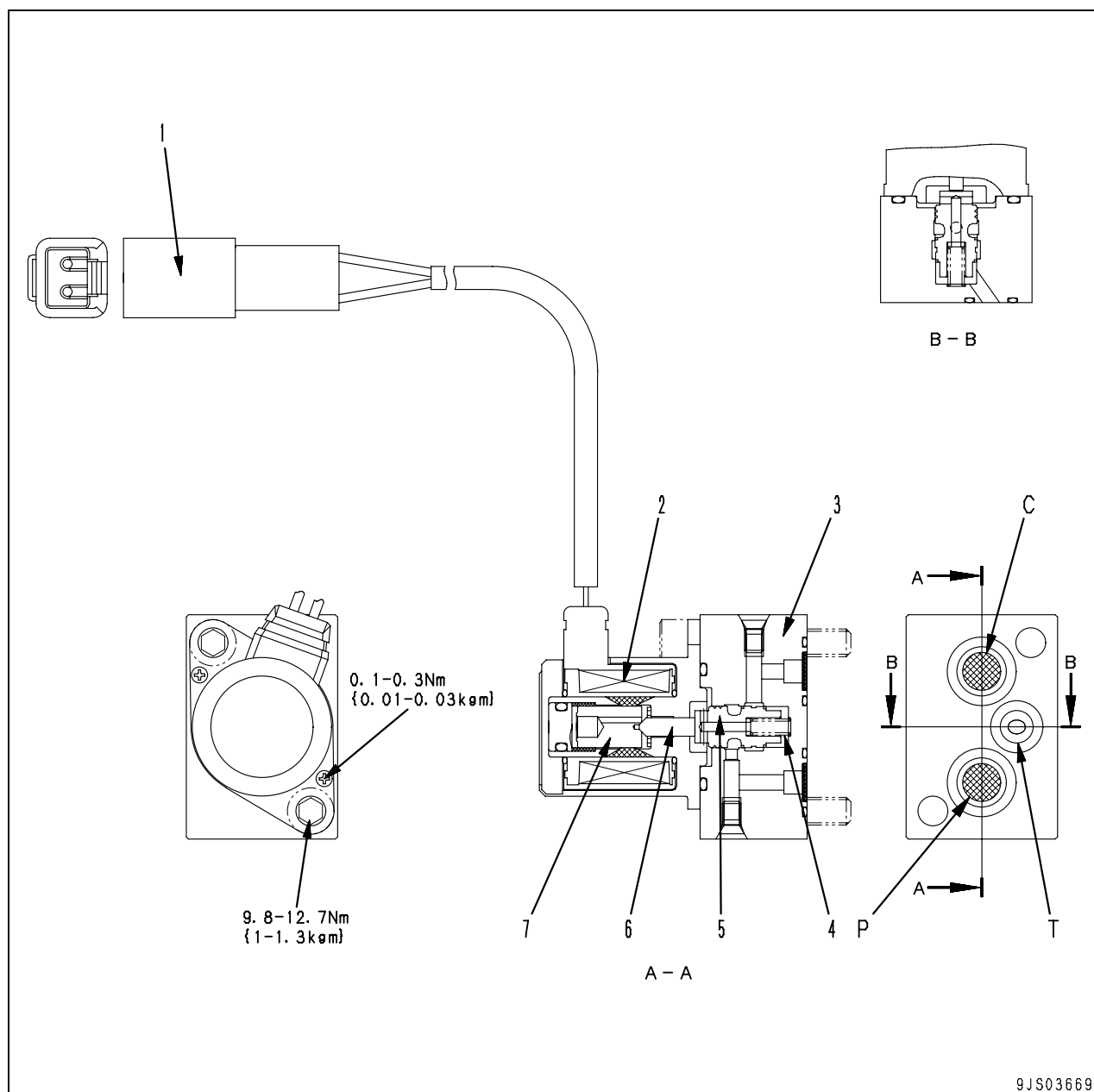


- If the emergency pump drive switch is turned on in the same way as in above, the command current (X) sent to PC-EPC valve solenoid (1) becomes constant.
- For this reason, the force of piston (2) pushing spool (3) is constant.
- If main pump pressures (PP1) and (PP2) increase, spool (3) moves further to the left than when the main pump load is light, and is balanced at the position in the figure above.
- In this case, the pressure from port (A) flows to port (C), so servo piston (9) moves to the left (smaller pump delivery) and stops at a position to the further to the left then when the load on the pump is light.

- When the emergency pump drive switch is turned on, too, the pump pressure (PP) and pump delivery (Q) have a relationship as shown with the curve in the figure corresponding to the current sent to the PC-EPC valve solenoid through the resistor.
- The curve resulting when the emergency pump drive switch is ON is situated further to the left (B) than when the pump controller is normal (A).



PC-EPC valve

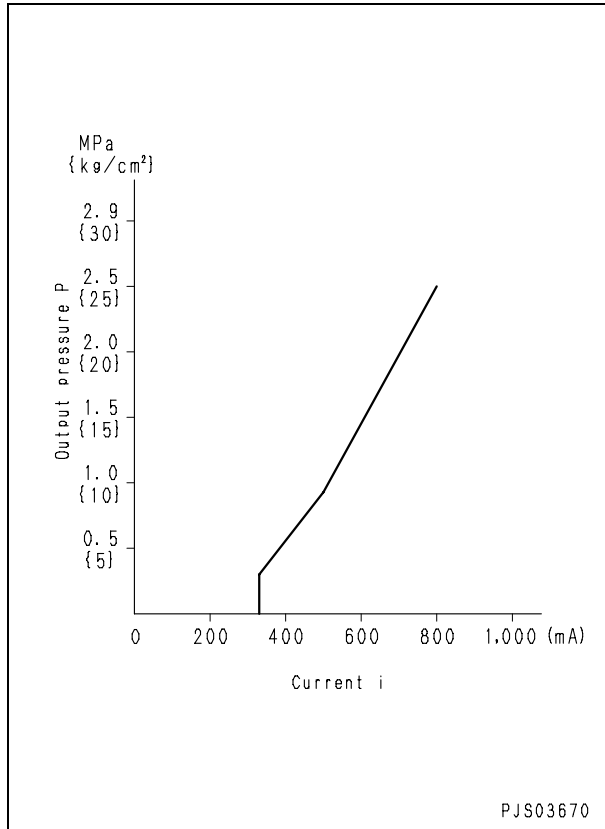


C : To PC valve
P : From self pressure reducing valve
T : To tank

1. Connector
2. Coil
3. Body
4. Spring
5. Spool
6. Rod
7. Plunger

Function

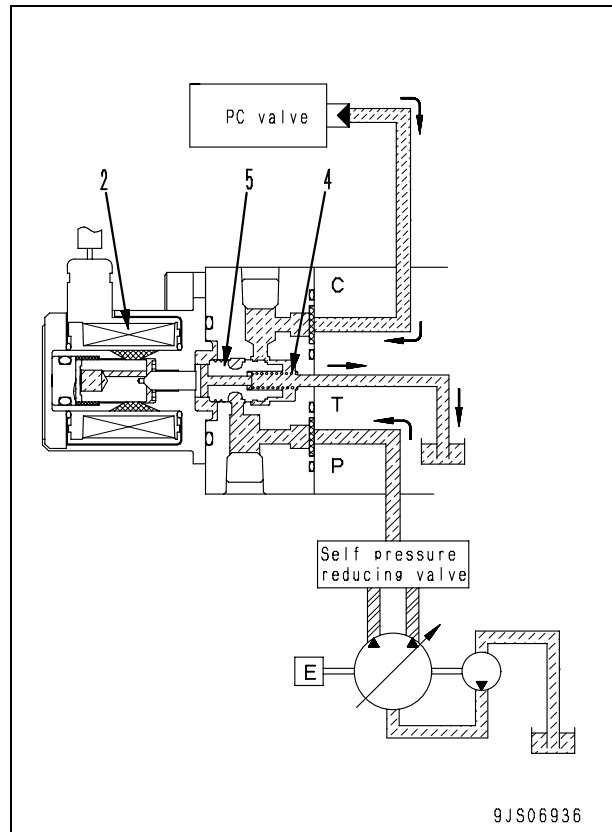
- The EPC valve consists of the proportional solenoid portion and the hydraulic valve portion.
- When it receives signal current (i) from the controller, it generates the EPC output pressure in proportion to the size of the signal, and outputs it to the PC valve.



Operation

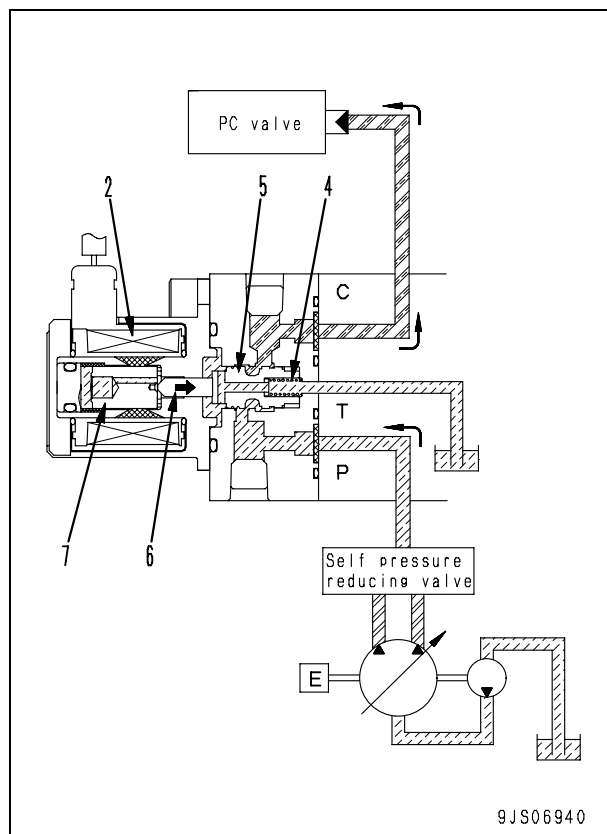
1. When signal current is 0 (coil is de-energized)

- When there is no signal current flowing from the controller to coil (2), coil (2) is de-energized.
- Spool (5) is pushed to the left by spring (4).
- Port (P) closes and the pressurized oil from the self pressure reducing valve does not flow to the PC valve.
- The pressurized oil from the PC valve is drained to the tank through port (C) and port (T).



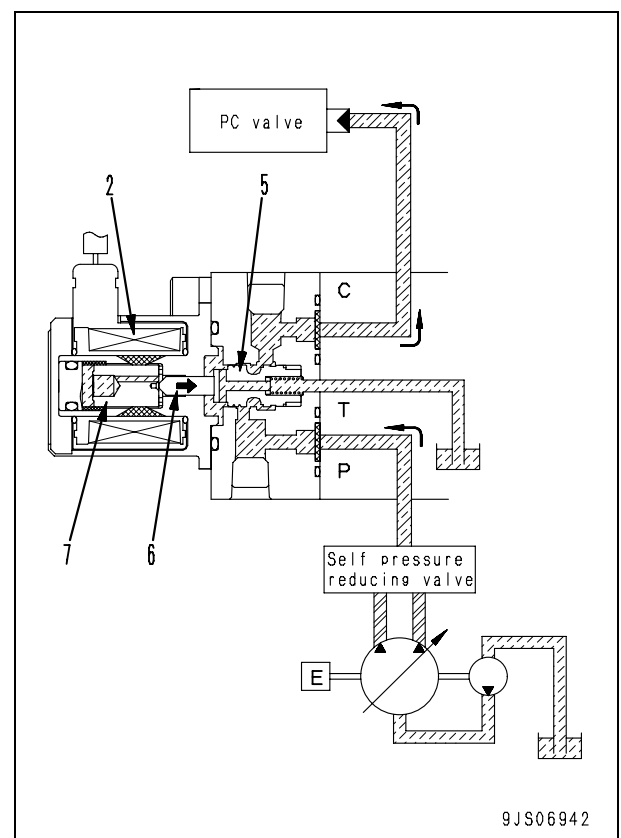
2. When signal current is very small (coil is energized)

- When a very small signal current flows to coil (2), coil (2) is energized, and a propulsion force is generated on the right side of plunger (7).
- Rod (6) pushes spool (5) to the right, and pressurized oil flows from port (P) to port (C).
- Pressures on port (C) increases and the force to act on spool (5) surface and the spring load on spring (4) become larger than the propulsion force of plunger (7).
- Spool (5) is pushed to the left, and port (P) is shut off from port (C).
- Port (C) and port (T) are connected.
- Spool (5) moves up and down so that the propulsion force of plunger (7) may be balance with pressure of port (C) + spring load of spring (4).
- The circuit pressure between the EPC valve and the PC valve is controlled in proportion to the size of the signal current.

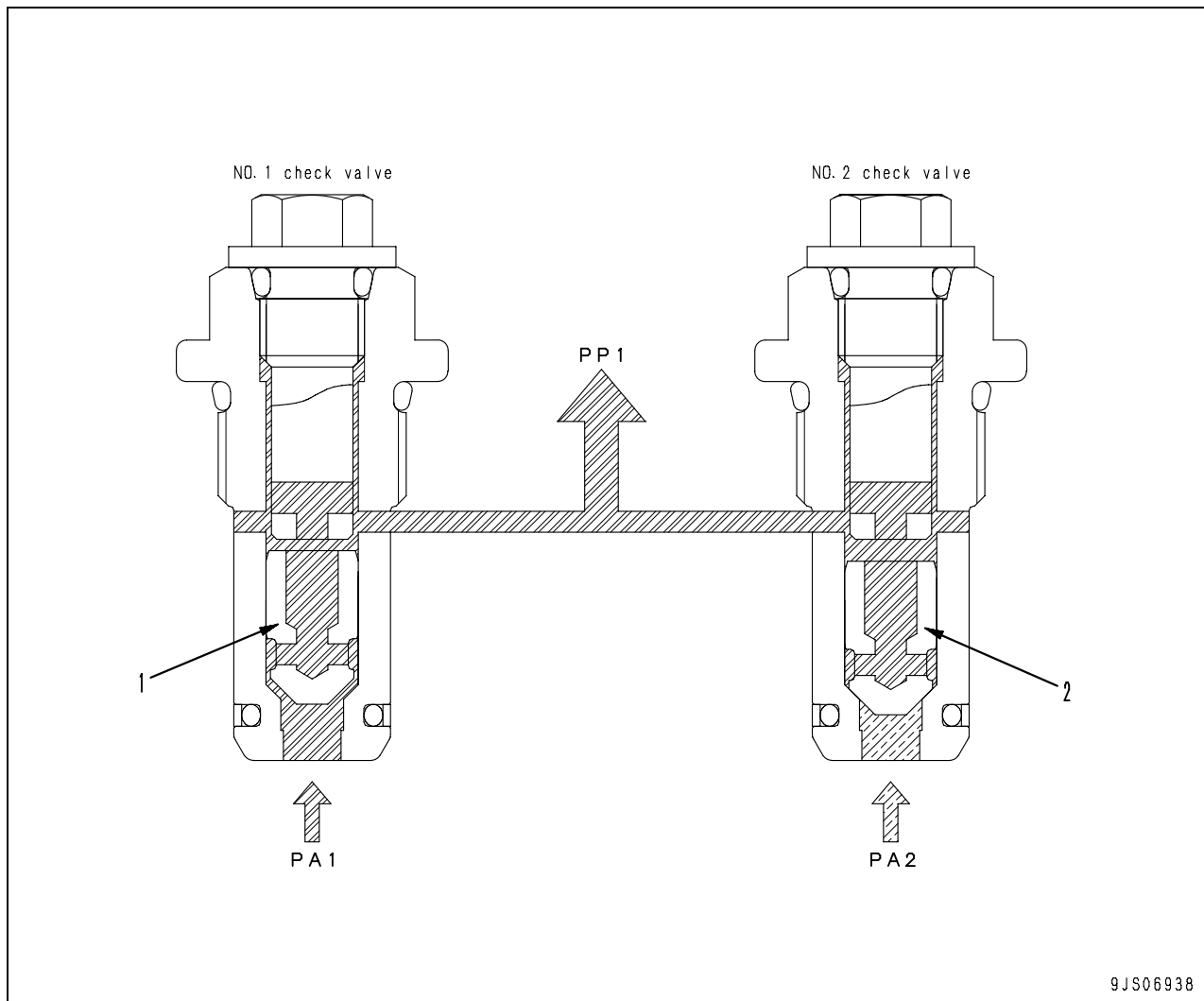


3. When signal current is maximum (coil is energized)

- As the signal current flows to coil (2), coil (2) is energized.
- When this happens, the signal current is at its maximum, so the propulsion force of plunger (7) is also at its maximum.
- Spool (5) is pushed toward right side by rod (6).
- The maximum volume of pressurized oil is conducted from port (P) to port (C), increasing the circuit pressure across EPC valve and PC valve to the maximum level.
- Since port (T) is closed, pressurized oil does not flow to the tank.



Check valve



PA1: Discharge pressure of main pump
 PA2: Discharge pressure of main pump
 PP1: Output pressure of check valve

1. Poppet valve
2. Poppet valve

Function

- A set of 2 check valves is used to select and output the higher discharge pressure of the 2 main pumps.

Operation

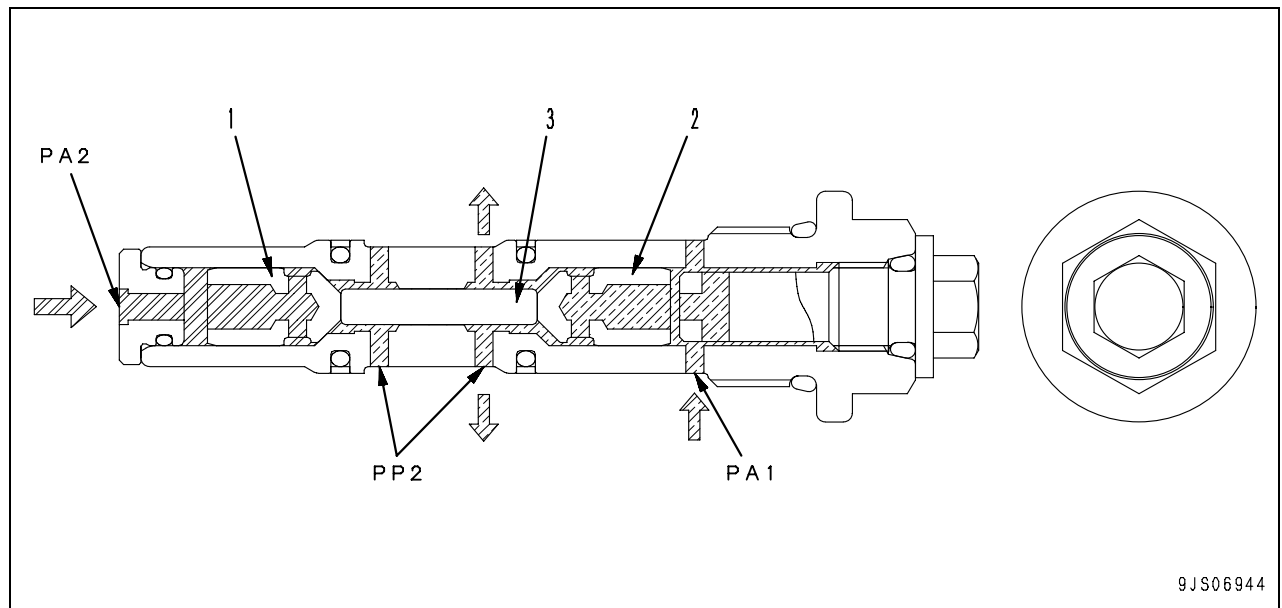
1. When $(PA1) > (PA2)$

- Discharge pressures (PA1) and (PA2) of the main pumps are applied to poppet valves (1) and (2). Since $(PA1) > (PA2)$, however, poppet valve (2) is kept closed and (PA1) is output to (PP1).

2. When $(PA1) < (PA2)$

- Reversely to 1., poppet valve (1) is kept closed and (PA2) is output to (PP1).

Shuttle valve



PA1: Discharge pressure of main pump

PA2: Discharge pressure of main pump

PP2: Output pressure of shuttle valve

1. Poppet valve
2. Poppet valve
3. Pin

Function

- The shuttle valve selects and outputs the lower discharge pressure of the 2 main pumps.

Operation

- The discharge pressures (PA1) and (PA2) of the 2 main pumps are applied to poppet valves (1) and (2) respectively.
- Since poppet valves (1) and (2) push each other through pin (3), either one of them receiving higher pressure is closed and the other one receiving lower pressure is opened.
- Accordingly, lower discharge pressure of the 2 main pumps is output.

PC160LC-7E0, PC180LC/NLC-7E0 Hydraulic excavator

Form No. UEN01902-00

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HYDRAULIC EXCAVATOR

PC160LC-7E0
PC180LC-7E0
PC180NLC-7E0

Machine model	Serial number
PC160LC-7E0	K45001 and up
PC180LC-7E0	K45001 and up
PC180NLC-7E0	K45001 and up

10 Structure, function and maintenance standard

Hydraulic system, Part 2

Control valve	2
CLSS.....	16
Functions and operation by valve	20

Control valve

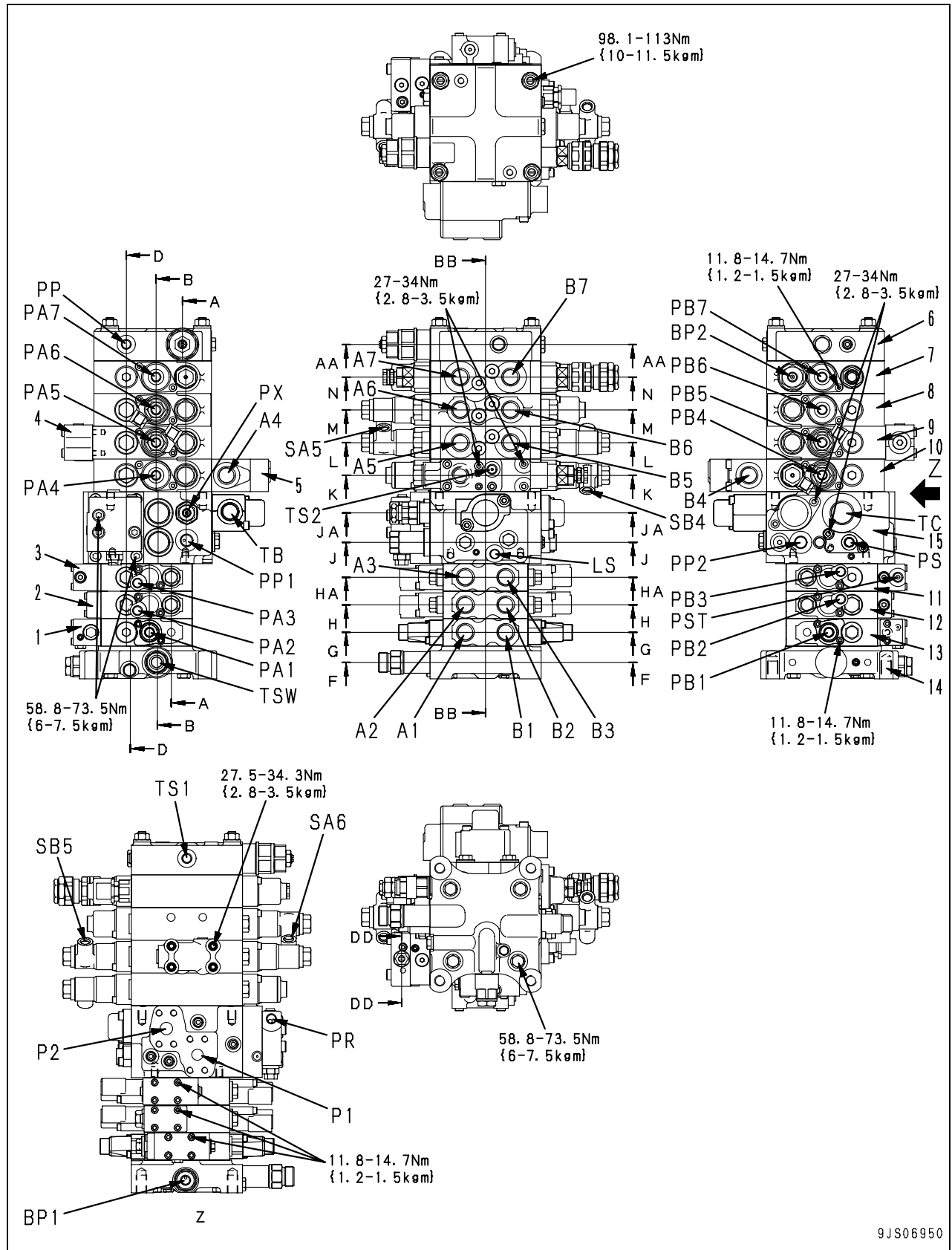
Outline

The following 4 types of control valve are set.

- 6-spool valve (Without service valve)
- 6-spool valve (Without service valve, with arm lock valve)
- 7-spool valve (6-spool valve + Service valve)
- 7-spool valve (6-spool valve + Service valve, with arm lock valve)

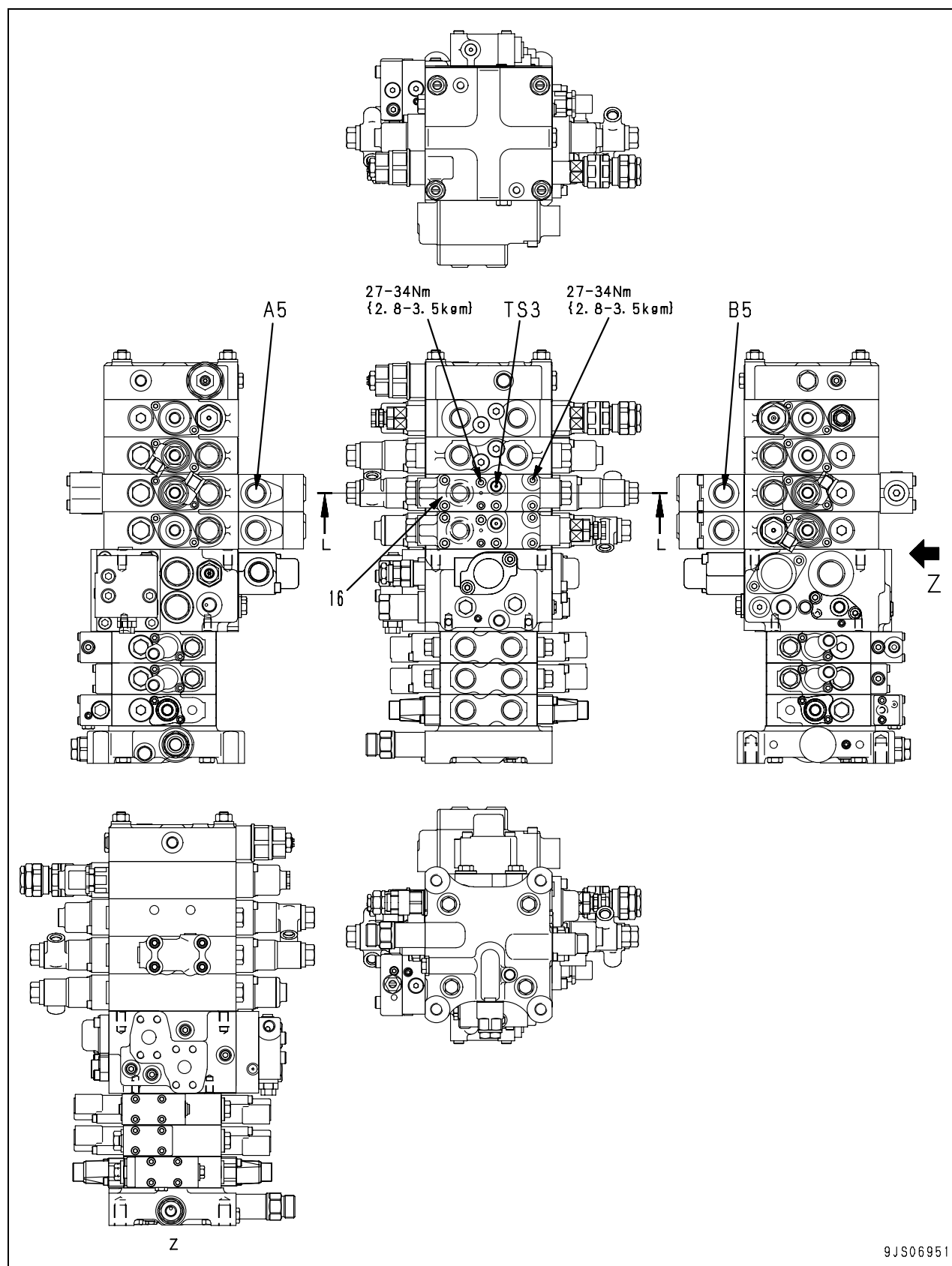
The outside view and section of only 7-spool valve (6-spool valve + service valve) are shown here.
The specifications of only the arms of the valves having arm lock valves are added, however.

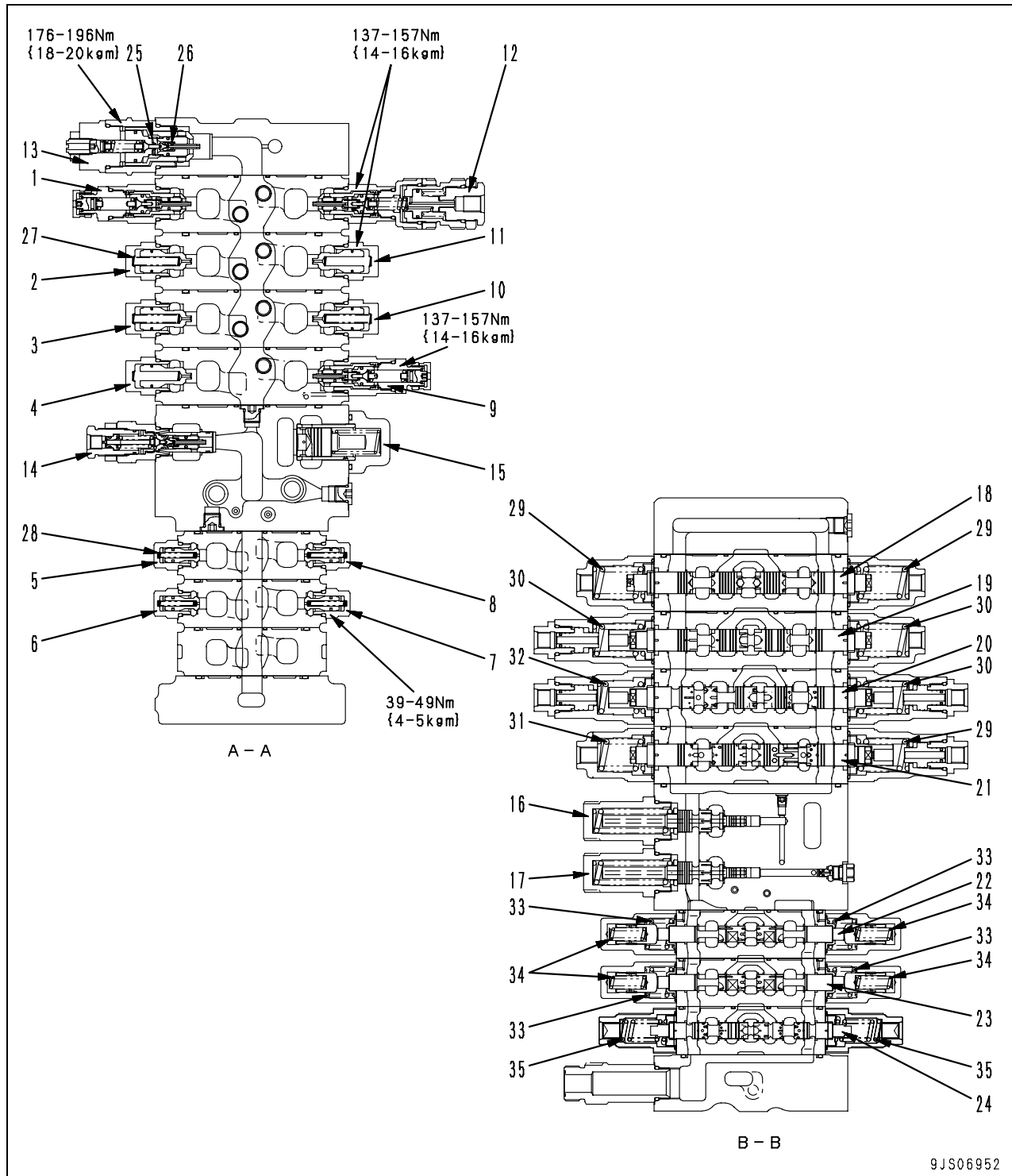
A1: To swing motor	PA1: From swing left PPC valve
A2: To right travel motor	PA2: From right travel forward PPC valve
A3: To left travel motor	PA3: From left travel forward PPC valve
A4: To boom cylinder bottom	PA4: From boom raise PPC valve
A5: To arm cylinder head	PA5: From arm OUT PPC valve
A6: To bucket cylinder head	PA6: From bucket dump PPC valve
A7: To attachment	PA7: From service 1 PPC valve
B1: To swing motor	PB1: From swing right PPC valve
B2: To right travel motor	PB2: From right travel reverse PPC valve
B3: To left travel motor	PB3: From left travel reverse PPC valve
B4: To boom cylinder head	PB4: From boom lower PPC valve
B5: To arm cylinder bottom	PB5: From arm IN PPC valve
B6: To bucket cylinder bottom	PB6: From bucket CURL PPC valve
B7: To attachment	PB7: From service 1 PPC valve
LS: To pump LS valve	PP1: Pressure sensor port (If equipped with pressure sensor)
P1: From main pump	PP2: Pressure sensor port (If equipped with pressure sensor)
P2: From main pump	PST: From travel junction solenoid valve
PP: To main pump	SA5: From travel PPC valve
PR: To solenoid valve, PPC valve, and EPC valve	SA6: From travel PPC valve
PS: From merge-divider solenoid valve	SB4: From travel PPC valve
PX: From 2-stage relief solenoid valve	SB5: From travel PPC valve
TB: To tank	TS1: To tank
TC: To oil cooler	TS2: To tank
BP1: From boom raise PPC valve	TS3': To tank (For arm lock valve specification)
BP2: From attachment circuit selector solenoid valve	TSW: To swing motor
1. Swing bleeding valve	9. Arm valve
2. LS check valve	10. Boom valve
3. Travel junction valve + LS check valve	11. Left travel valve
4. Arm regeneration valve	12. Right travel valve
5. Boom hydraulic drift prevention valve	13. Swing valve
6. Cover	14. Block
7. Service valve	15. Pump merge-divider valve block
8. Bucket valve	16. Arm hydraulic drift prevention valve



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Specification with arm lock valve

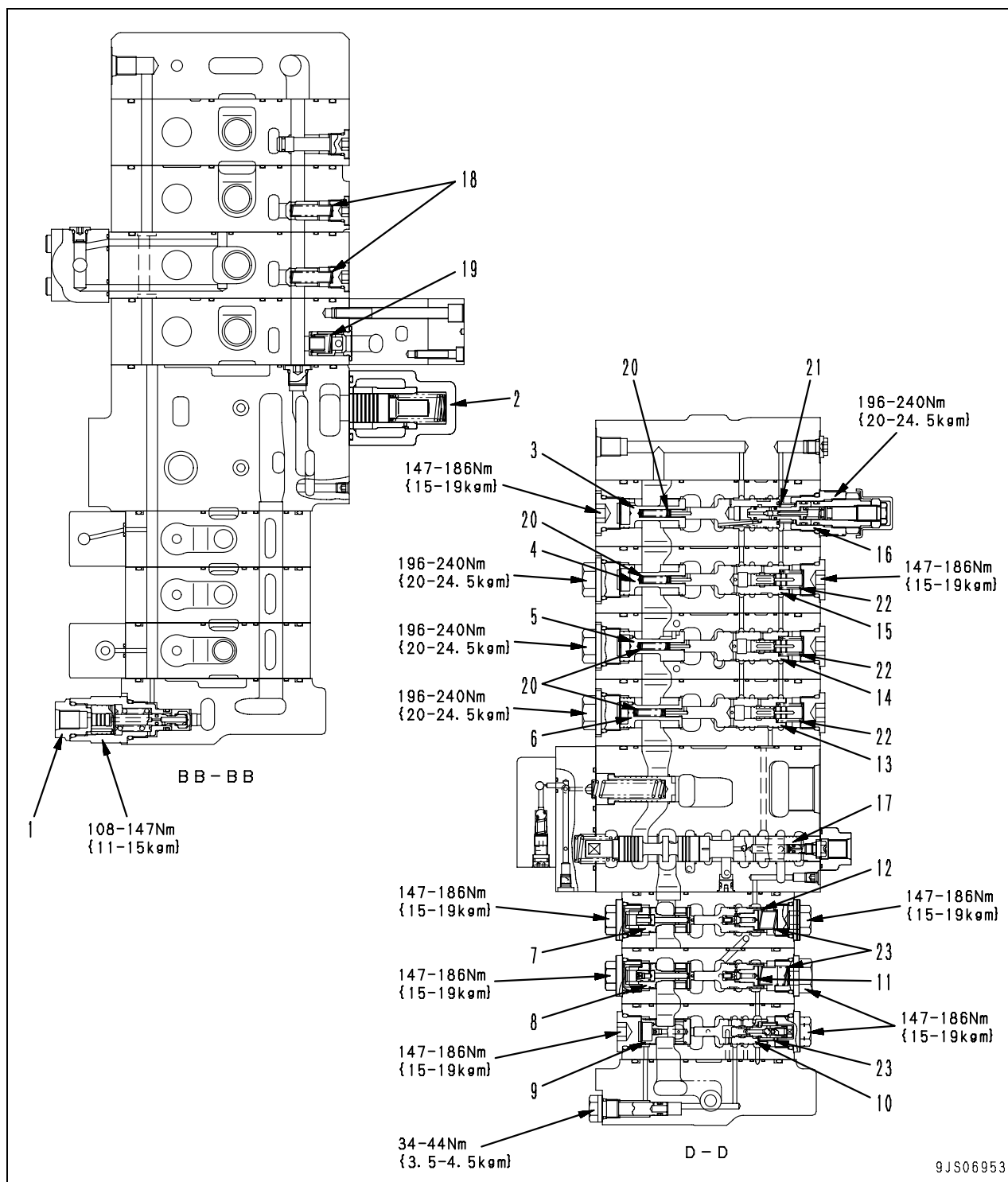




1. Suction safety valve (Service)
2. Suction valve (Bucket)
3. Suction valve (Arm)
4. Suction valve (Boom)
5. Suction valve (Left travel)
6. Suction valve (Right travel)
7. Suction valve (Right travel)
8. Suction valve (Left travel)
9. Suction safety valve (Boom)
10. Suction valve (Arm)
11. Suction valve (Bucket)
12. Suction safety valve (Service)
13. Suction safety valve
14. Main relief valve
15. Lift check valve
16. Unload valve
17. Unload valve
18. Spool (Service)
19. Spool (Bucket)
20. Spool (Arm)
21. Spool (Boom)
22. Spool (Left travel)
23. Spool (Right travel)
24. Spool (Swing)

Unit: mm

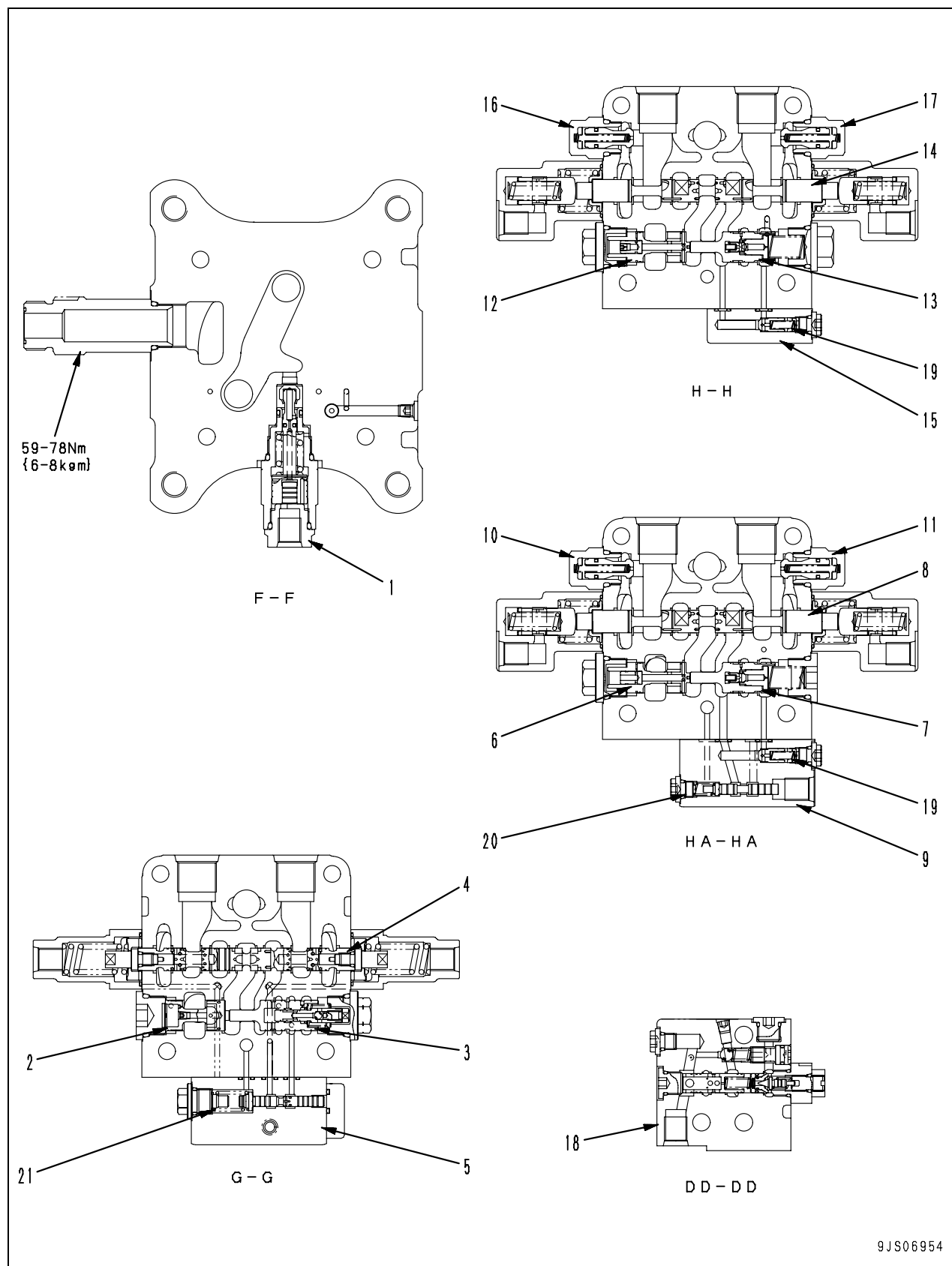
No.	Check item	Criteria					Remedy
25	Piston spring	Standard size			Repair limit		If damaged or deformed, replace spring
		Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	
		16 x 16	12.6	4.9 N {0.5 kg}	—	3.9 N {0.4 kg}	
26	Suction spring	10.5 x 7	6.8	2.0 N {0.21 kg}	—	1.6 N {0.17 kg}	
27	Suction spring	46.8 x 7.5	40.6	5.5 N {0.56 kg}	—	4.4 N {0.45 kg}	
28	Suction spring	39.2 x 4.5	33.5	5.1 N {0.52 kg}	—	4.1 N {0.42 kg}	
29	Spool return spring	45.6 x 28	43	231 N {23.5 kg}	—	185 N {18.8 kg}	
30	Spool return spring	45.7 x 28	43	221 N {22.6 kg}	—	177 N {18.1 kg}	
31	Spool return spring	42.4 x 28	39	221 N {22.6 kg}	—	177 N {18.1 kg}	
32	Spool return spring	42.1 x 28	39	221 N {22.6 kg}	—	177 N {18.1 kg}	
33	Spool return spring	27.1 x 25.8	25.5	56 N {5.7 kg}	—	45 N {4.6 kg}	
34	Spool return spring	32.4 x 11	31.4	60 N {6.1 kg}	—	48 N {4.9 kg}	
35	Spool return spring	41.8 x 19	38.5	141 N {14.4 kg}	—	113 N {11.5 kg}	



1. LS selector valve
 2. Cooler bypass valve
 3. Pressure compensation valve F (Service)
 4. Pressure compensation valve F (Bucket)
 5. Pressure compensation valve F (Arm)
 6. Pressure compensation valve F (Boom)
 7. Pressure compensation valve F (Left travel)
 8. Pressure compensation valve F (Right travel)
 9. Pressure compensation valve F (Swing)
 10. Pressure compensation valve R (Swing)
 11. Pressure compensation valve R (Right travel)
 12. Pressure compensation valve R (Left travel)
 13. Pressure compensation valve R (Boom)
 14. Pressure compensation valve R (Arm)
 15. Pressure compensation valve R (Bucket)
 16. Variable pressure compensation valve (Service)
 17. Pump merge-divider valve spool
- F: Flow control valve
R: Pressure reducing valve

Unit: mm

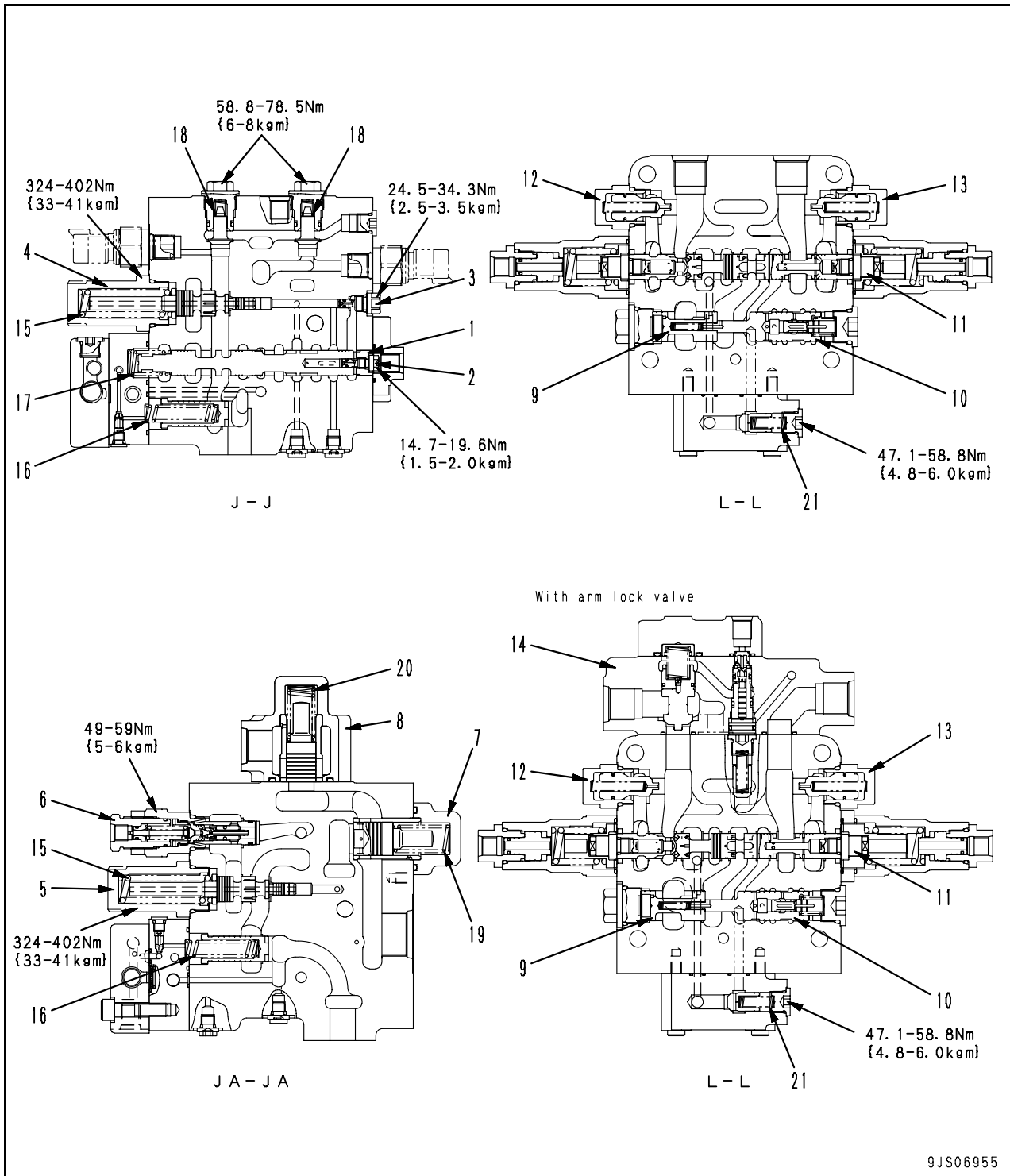
No.	Check item	Criteria					Remedy
18	Check valve spring	Standard size			Repair limit		If damaged or deformed, replace spring
		Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	
		41.5 x 8.5	31.5	5.9 N {0.6 kg}	—	4.7 N {0.5 kg}	
19	Check valve spring	20.3 x 13.7	16	2.9 N {0.3 kg}	—	2.3 N {0.24 kg}	
20	Flow control valve spring	36.2 x 5.3	32	9.8 N {1 kg}	—	7.8 N {0.8 kg}	
21	Pressure reducing valve spring	29.1 x 15	14.5	9.8 N {1 kg}	—	7.8 N {0.8 kg}	
22	Pressure reducing valve spring	27.5 x 14.2	18	17.6 N {1.8 kg}	—	14 N {1.4 kg}	
23	Pressure reducing valve spring	28 x 14.4	14.5	13.7 N {1.4 kg}	—	11 N {1.1 kg}	



- | | |
|--|--|
| 1. LS selector valve | 12. Pressure compensation valve F (Right travel) |
| 2. Pressure compensation valve F (Swing) | 13. Pressure compensation valve R (Right travel) |
| 3. Pressure compensation valve R (Swing) | 14. Spool (Right travel) |
| 4. Spool (Swing) | 15. LS check valve |
| 5. LS bleeding valve | 16. Suction valve (Right travel) |
| 6. Pressure compensation valve F (Left travel) | 17. Suction valve (Right travel) |
| 7. Pressure compensation valve R (Left travel) | 18. Self-pressure reducing valve |
| 8. Spool (Left travel) | |
| 9. Travel junction valve + LS check valve | F: Flow control valve |
| 10. Suction valve (Left travel) | R: Pressure reducing valve |
| 11. Suction valve (Left travel) | |

Unit: mm

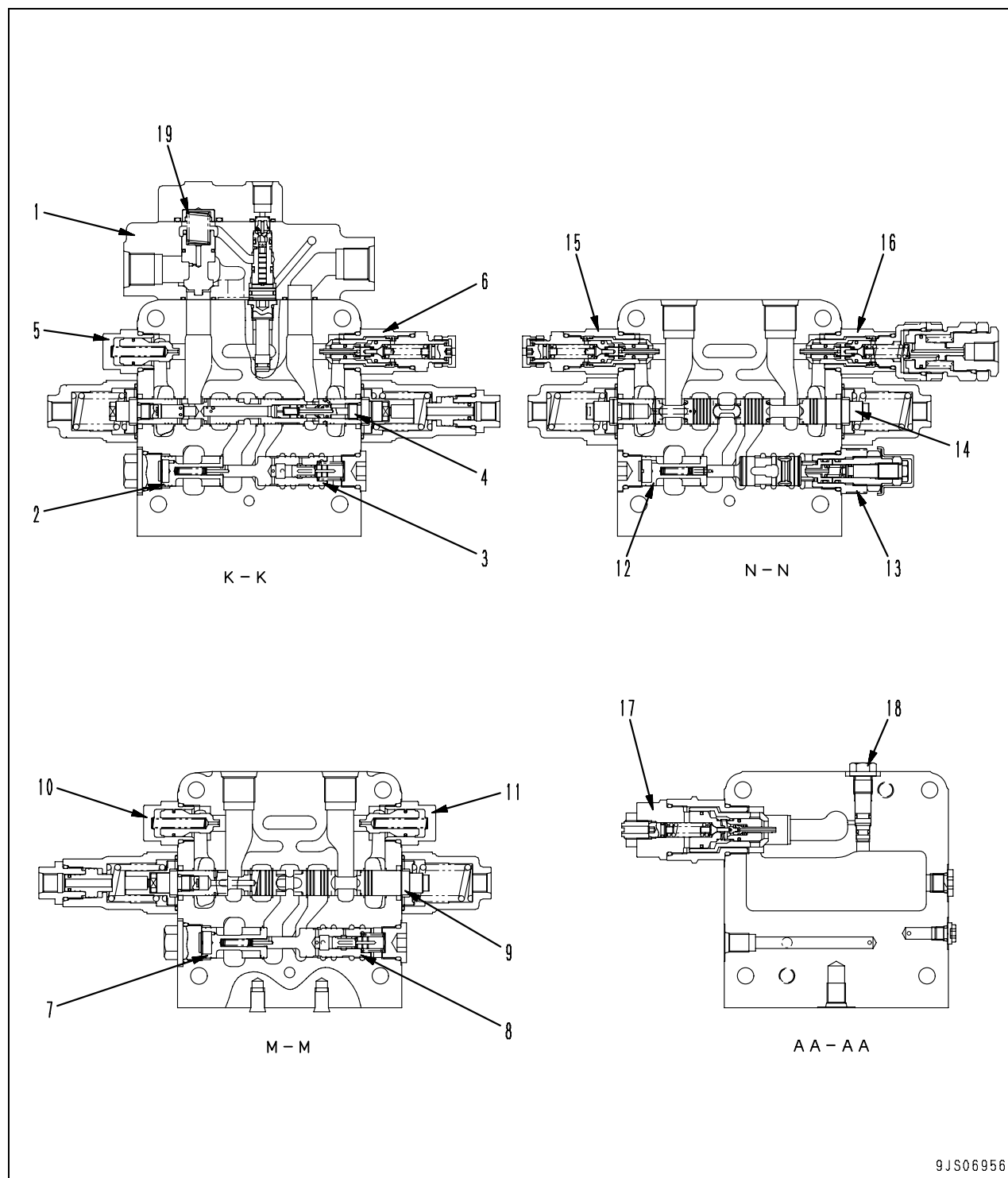
No.	Check item	Criteria					Remedy
19	Check valve spring	Standard size			Repair limit		If damaged or deformed, replace spring
		Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	
		21.9 x 5	15.8	2.0 N {0.2 kg}	—	1.6 N {0.16 kg}	
20	Travel junction spool return spring	19.3 x 7.5	14	15.7 N {1.6 kg}	—	12.6 N {1.3 kg}	
21	Bleed spool return spring	23.3 x 12.5	23	3.9 N {0.4 kg}	—	3.1 N {0.3 kg}	



1. Merge-divider spool
 2. LS bypass valve
 3. LS bypass valve
 4. Unload valve
 5. Unload valve
 6. Main relief valve
 7. Lift check valve
 8. Cooler bypass valve
 9. Pressure compensation valve F (Arm)
 10. Pressure compensation valve R (Arm)
 11. Spool (Arm)
 12. Suction valve (Arm)
 13. Suction valve (Arm)
 14. Hydraulic drift prevention valve (Arm)
- F: Flow control valve
R: Pressure reducing valve

Unit: mm

No.	Check item	Criteria					Remedy
15	Unload valve spring	Standard size			Repair limit		If damaged or deformed, replace spring
		Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	
		76.8 x 20.9	70	422 N {43.1 kg}	—	337 N {34.5 kg}	
16	Sequence valve spring	58.9 x 13	53	83.4 N {8.5 kg}	—	66.7 N {6.8 kg}	
17	Pump merge-divider valve spool return spring	49.8 x 18.8	33	98 N {10 kg}	—	78.4 N {8 kg}	
18	Check valve spring	16.4 x 8.9	11.5	13.7 N {1.4 kg}	—	11 N {1.1 kg}	
19	Lift check valve spring	77.3 x 20.7	40	135 N {13.8 kg}	—	108 N {11 kg}	
20	Cooler bypass valve spring	67.5 x 20.6	42.5	112 N {11.4 kg}	—	89.6 N {9.1 kg}	
21	Check valve spring	41.5 x 8.5	31.5	5.9 N {0.6 kg}	—	4.7 N {0.48 kg}	



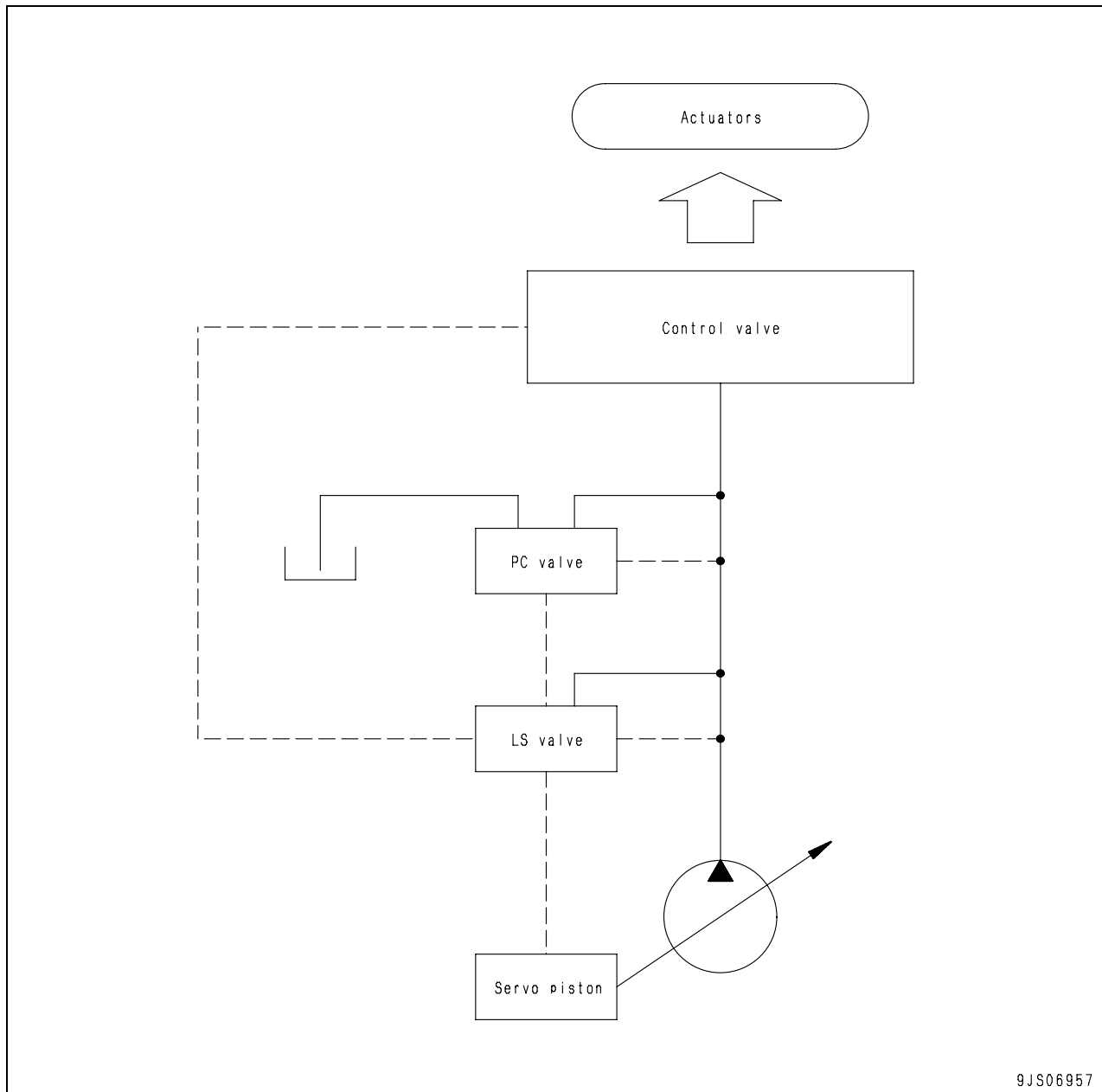
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|--|--|
| 1. 1.Hydraulic drift prevention valve (Boom) | 12. Pressure compensation valve F (Service) |
| 2. Pressure compensation valve F (Boom) | 13. Variable pressure compensation valve (Service) |
| 3. Pressure compensation valve R (Boom) | 14. Spool (Service) |
| 4. Spool (Boom) | 15. Suction safety valve |
| 5. Suction valve | 16. Suction safety valve |
| 6. Suction safety valve | 17. Suction safety valve |
| 7. Pressure compensation valve F (Bucket) | 18. Air bleed plug |
| 8. Pressure compensation valve R (Bucket) | |
| 9. Spool (Bucket) | |
| 10. Suction valve | F: Flow control valve |
| 11. Suction valve | R: Pressure reducing valve |

Unit: mm

No.	Check item	Criteria					Remedy
19	Lock valve spring	Standard size			Repair limit		If damaged or deformed, replace spring
		Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	
		33.9 x 17	21	26.5 N {2.7 kg}	—	21.2 N {2.2 kg}	

CLSS

Outline of CLSS



Features

CLSS stands for Closed centre Load Sensing System, which has the following characteristics:

- Fine control not influenced by load
- Controllability enabling digging even with fine control
- Ease of compound operation ensured by flow divider function using area of opening of spool during compound operations
- Energy saving using variable pump control

Configuration

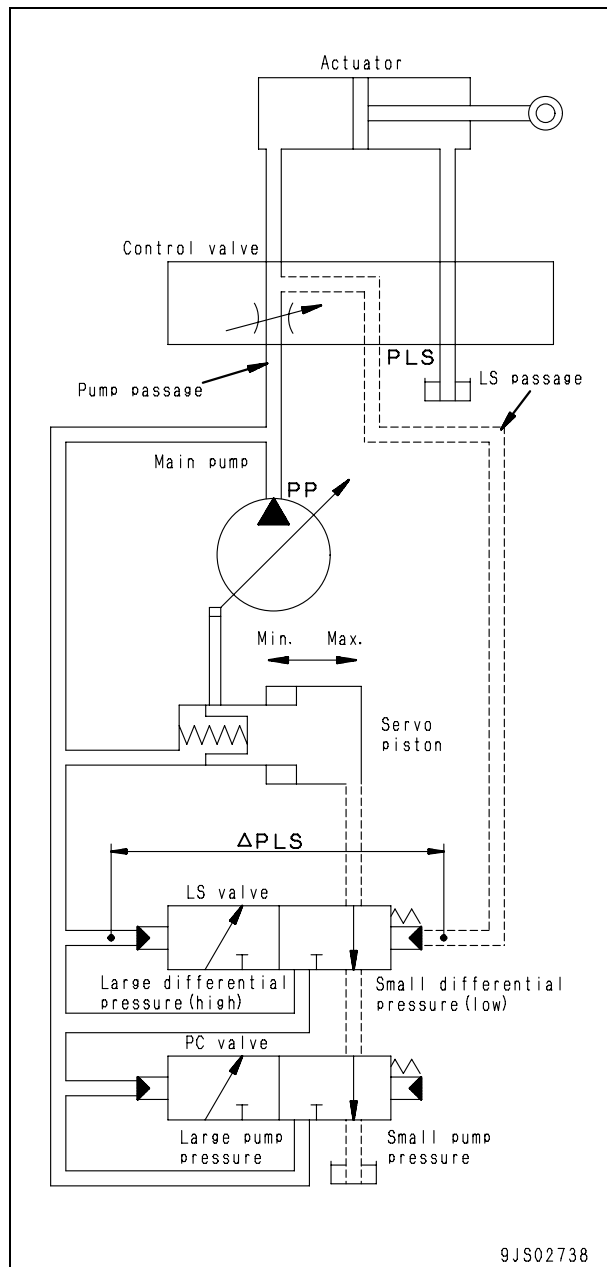
- CLSS is configured with variable capacity piston pumps, control valves, and respective actuators.
- The hydraulic pump is configured with pump body, PC valve and LS valve.

Basic principle

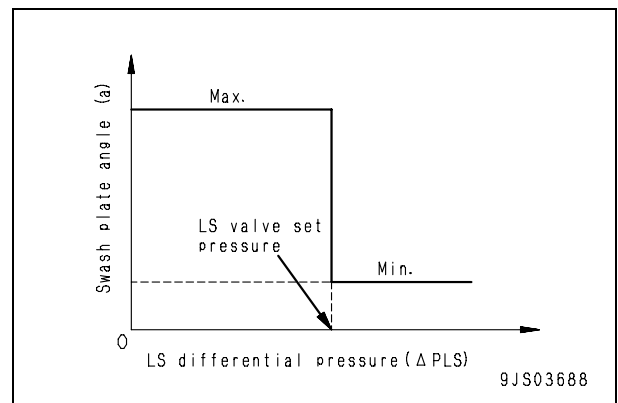
1. Pump swash plate angle control

- The pump swash plate angle (pump delivery) is controlled so that LS differential pressure (ΔPLS) (the difference between pump pressure PP and control valve outlet port LS pressure PLS) (load pressure of actuator) is constant.
- [LS differential pressure (ΔPLS) = Pump discharge pressure (PP) — LS pressure (PLS)]

- The pump swash plate angle shifts toward the maximum position if LS differential pressure (ΔPLS) is lower than the set pressure of the LS valve (when the actuator load pressure is high).
- If it becomes higher than the set pressure (when the actuator load pressure is low), the pump swash plate angle shifts toward the minimum position.

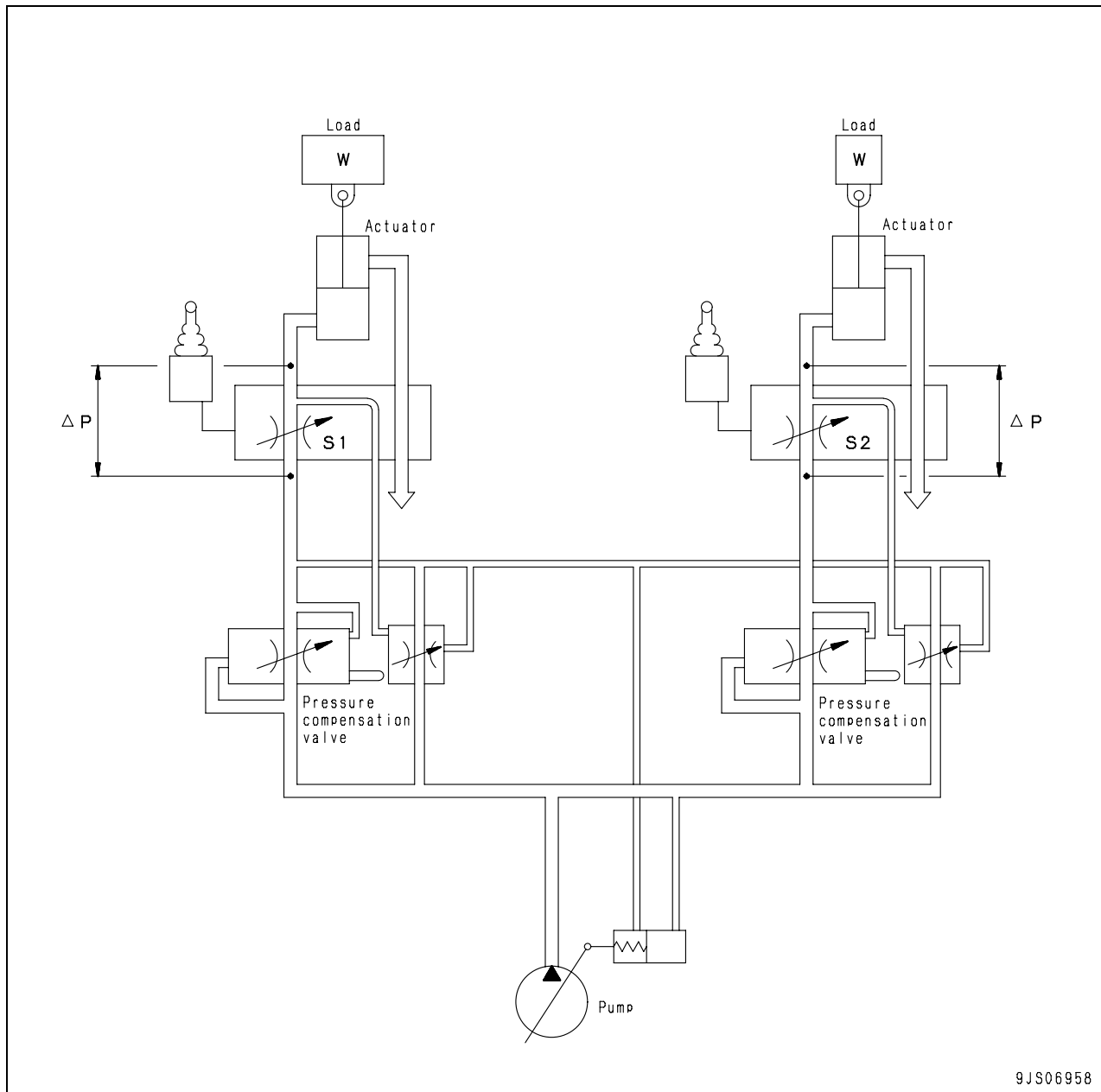


LS differential pressure (ΔPLS) and pump swash plate angle



- ★ For details of functions, see the "Hydraulic pump" paragraph.

2. Pressure compensation control

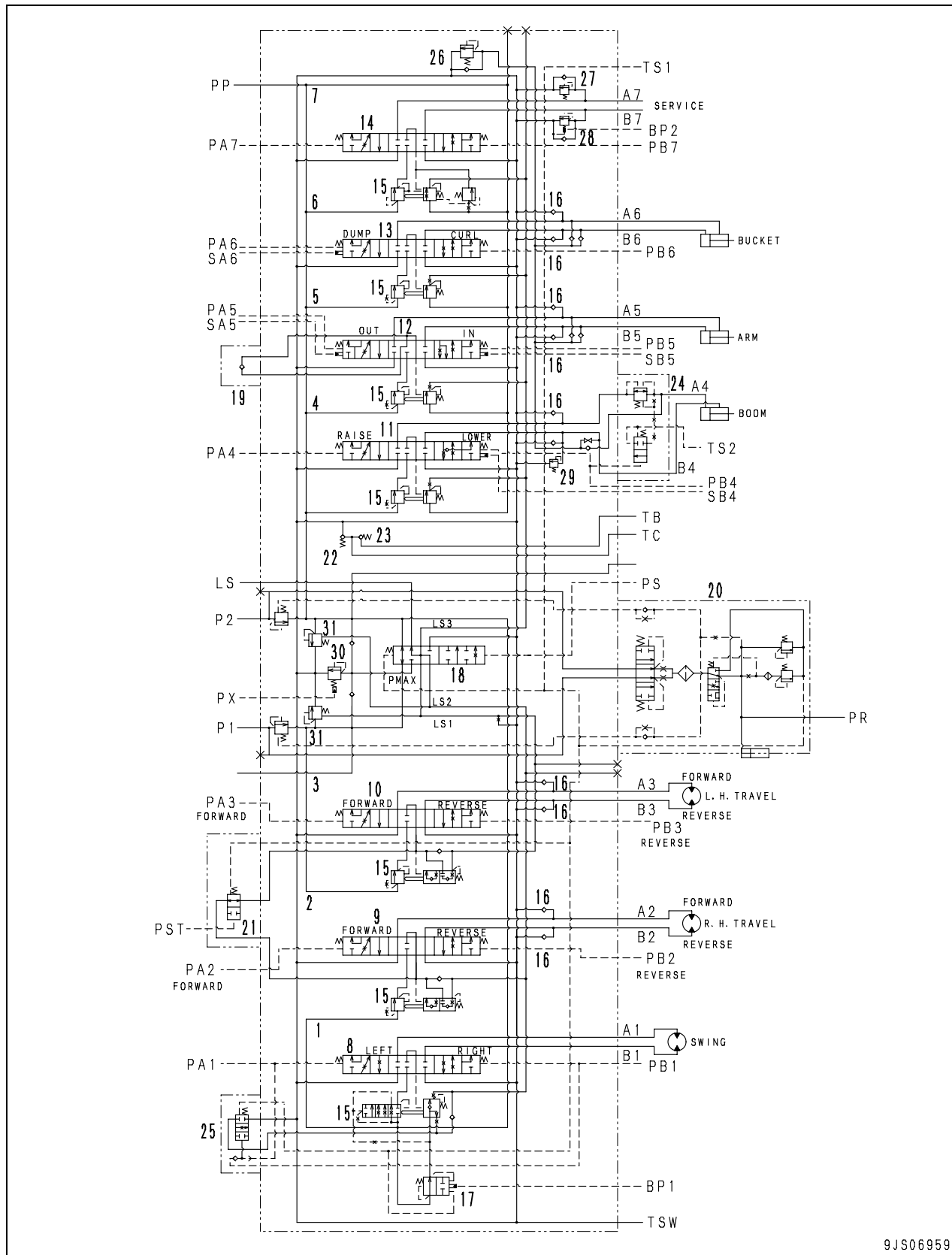


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- A pressure compensation valve is installed to the outlet port side of the control valve to balance the load.
- When actuators are operated together, the pressure difference (ΔP) between the upstream (inlet port) and downstream (outlet port) of the spool of each valve becomes the same regardless the size of the load (pressure).
- The flow of oil from the pump is divided (compensated) in proportion to the area of opening (S1) and (S2) of each valve.

Functions and operation by valve

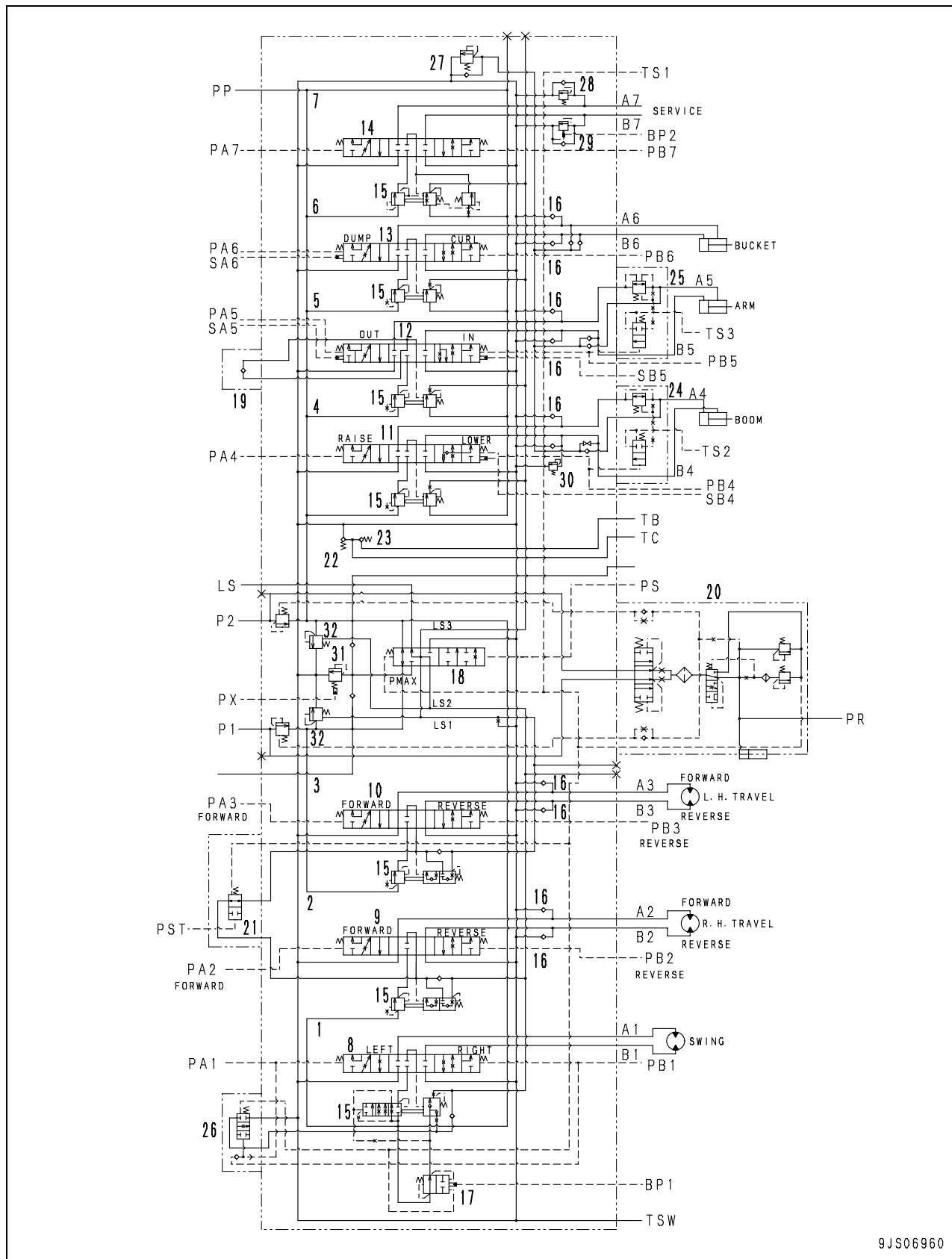
Hydraulic circuit diagram and the name of valves



9JS06959

1. Swing valve
2. R.H. travel valve
3. L.H. travel valve
4. Boom valve
5. Arm valve
6. Bucket valve
7. Service valve
8. Swing spool
9. R.H. travel spool
10. L.H. travel spool
11. Boom spool
12. Arm spool
13. Bucket spool
14. Service spool
15. Pressure compensation valve
16. Suction valve
17. LS select valve
18. Merge-divider valve
19. Arm regeneration valve
20. Self pressure reducing valve
21. Travel junction valve
22. Lift check valve
23. Cooler bypass valve
24. Boom hydraulic drift prevention valve
25. Swing bleeding valve
26. Suction safety valve
Set pressure: 38.2 MPa {390 kg/cm²}
27. Suction safety valve
Set pressure: 24.5 MPa {250 kg/cm²}
28. 2-stage suction safety valve
Set pressure:
1 stage: 24.5 ± 0.5 MPa {250 ± 5 kg/cm²}
2 stage: 20.6 ± 0.5 MPa {210 ± 5 kg/cm²}
29. Suction safety valve:
Set pressure:
31.4 ± 0.5 MPa {320 ± 5 kg/cm²}
30. Main relief valve:
Set pressure: 35.2 MPa {359 kg/cm²}
When digging force increased:
37.2 MPa {380 kg/cm²}
31. Unload valve
Cracking pressure:
5.4 – 7.4 MPa {55 – 75 kg/cm²}

Specification with arm lock valve

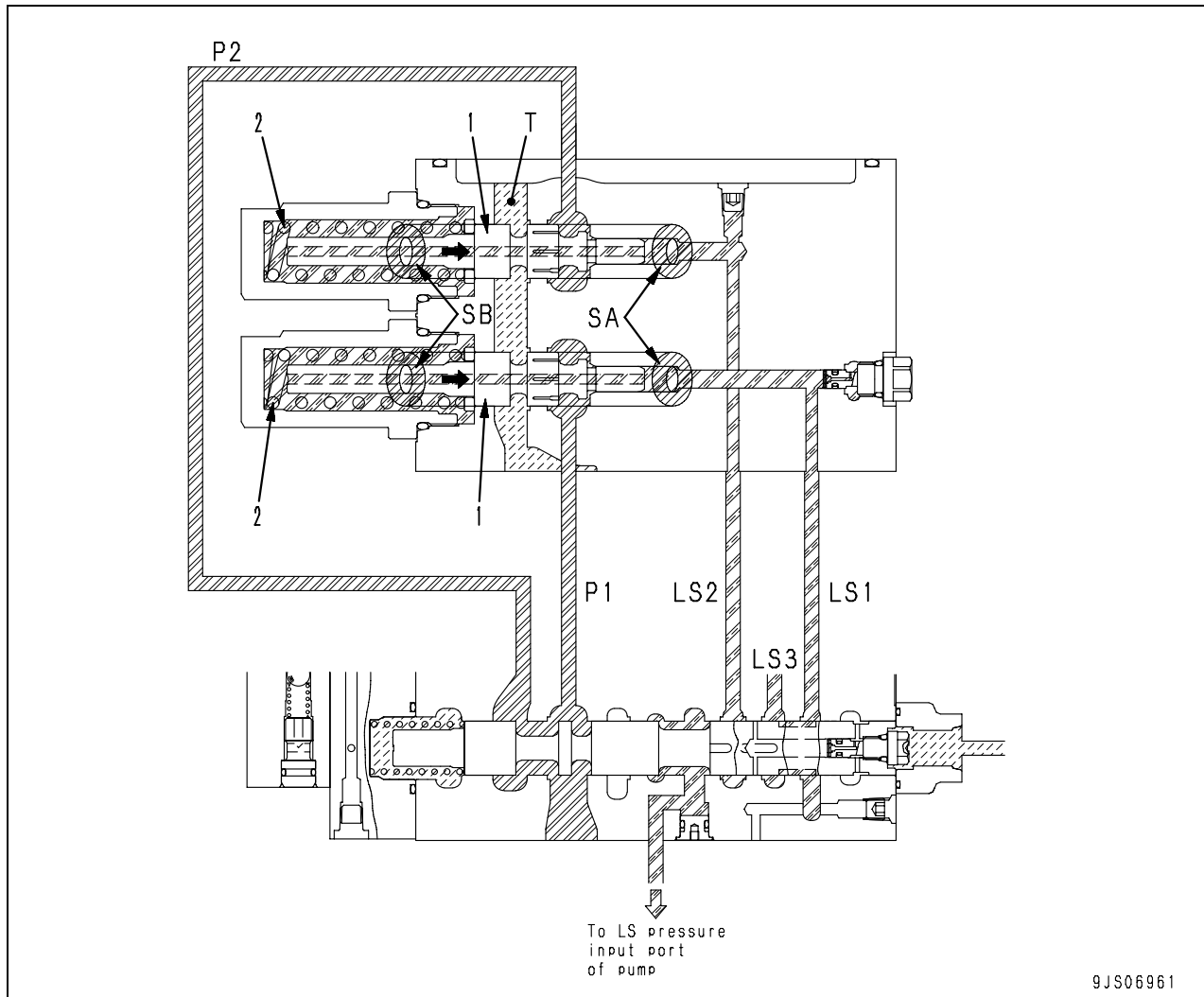


9JS06960

1. Swing valve
2. R.H. travel valve
3. L.H. travel valve
4. Boom valve
5. Arm valve
6. Bucket valve
7. Service valve
8. Swing spool
9. R.H. travel spool
10. L.H. travel spool
11. Boom spool
12. Arm spool
13. Bucket spool
14. Service spool
15. Pressure compensation valve
16. Suction valve
17. LS select valve
18. Merge-divider valve
19. Arm regeneration valve
20. Self pressure reducing valve
21. Travel junction valve
22. Lift check valve
23. Cooler bypass valve
24. Boom hydraulic drift prevention valve
25. Arm hydraulic drift prevention valve
26. Swing bleeding valve
27. Suction safety valve
Set pressure: 38.2 MPa {390 kg/cm²}
28. Suction safety valve
Set pressure: 24.5 MPa {250 kg/cm²}
29. 2-stage suction safety valve:
Set pressure:
1 stage: 24.5 ± 0.5 MPa {250 ± 5 kg/cm²}
2 stage: 20.6 ± 0.5 MPa {210 ± 5 kg/cm²}
30. Suction safety valve:
Set pressure:
31.4 ± 0.5 MPa {320 ± 5 kg/cm²}
31. Main relief valve:
Set pressure: 35.2 MPa {359 kg/cm²}
When digging force increased:
37.2 MPa {380 kg/cm²}
32. Unload valve
Cracking pressure:
5.4 – 7.4 MPa {55 – 75 kg/cm²}

Unload valve

1. When control valve is at HOLD



Function

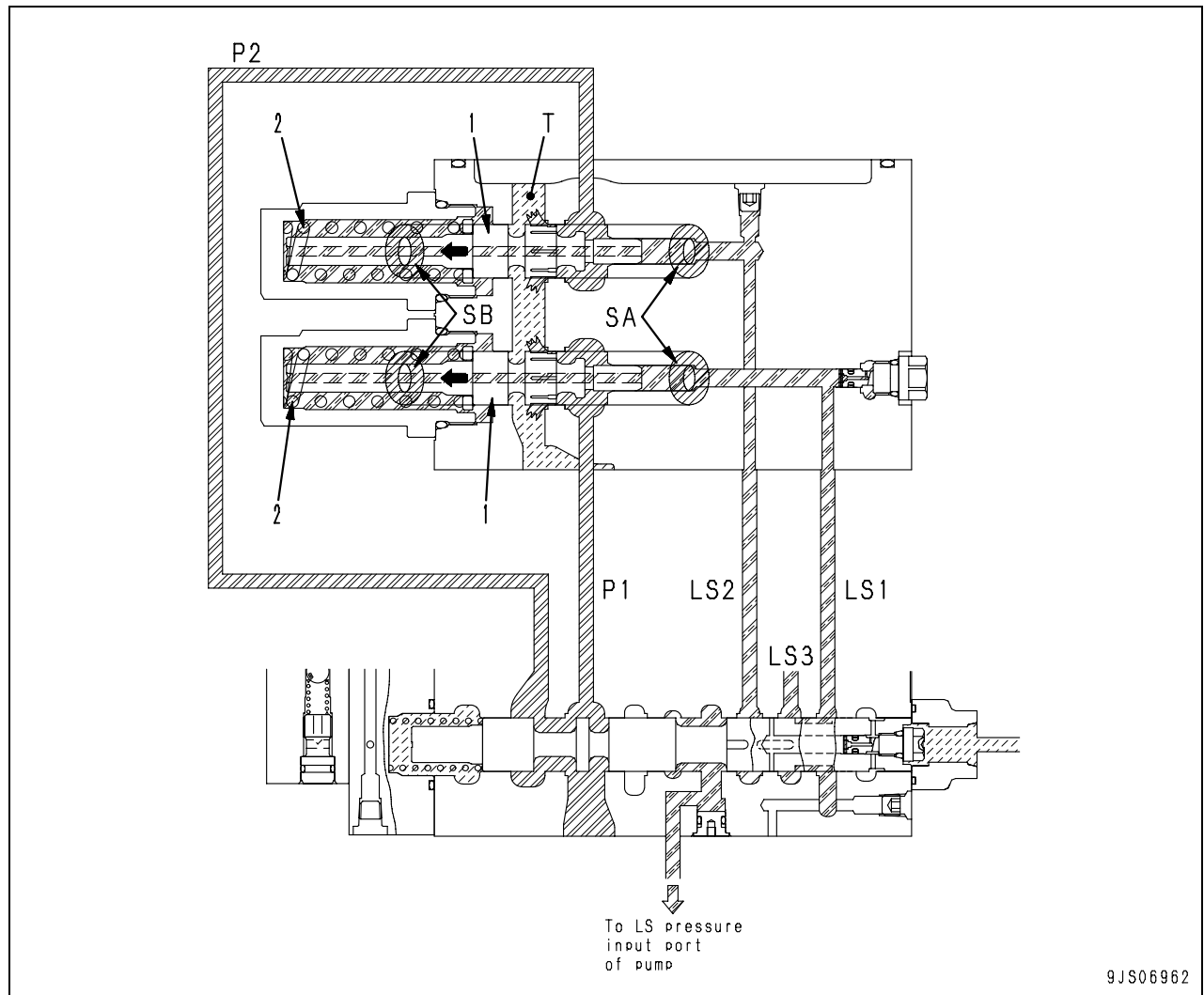
- When the control valve is at HOLD, pump delivery (Q) discharged by the minimum swash plate angle is released to the tank circuit. At this time, pump discharge pressure (P1) and (P2) is set by spring (2) in the valve. [LS pressure (LS1) and (LS2) = 0 MPa {0 kg/cm²}]
- Since the pump merge-divider valve is at the merge position, pump discharge pressures (P1) and (P2) are merged. LS pressures (LS1), (LS2), and (LS3) are also merged.

Operation

- Pump discharge pressures (P1) and (P2) are applied to pump pressure receiving (SA) face of unload spool (1).
- LS pressures (LS1) and (LS2) are applied to LS pressure receiving (SB) face. [(P1) = (P2), (LS1) = (LS2)]

- When the control valve is at HOLD, LS pressures (LS1) and (LS2) are not generated, so only pump discharge pressures (P1) and (P2) act, and (P1) and (P2) are set by only the load of spring (2).
- As pump discharge pressure (P1) and (P2) rises and reaches the load of spring (2), spool (1) is moved to the left. Pump discharge pressures (P1) and (P2) are connected to tank circuit (T) through the cut of spool (1).

2. When work equipment valve is operated



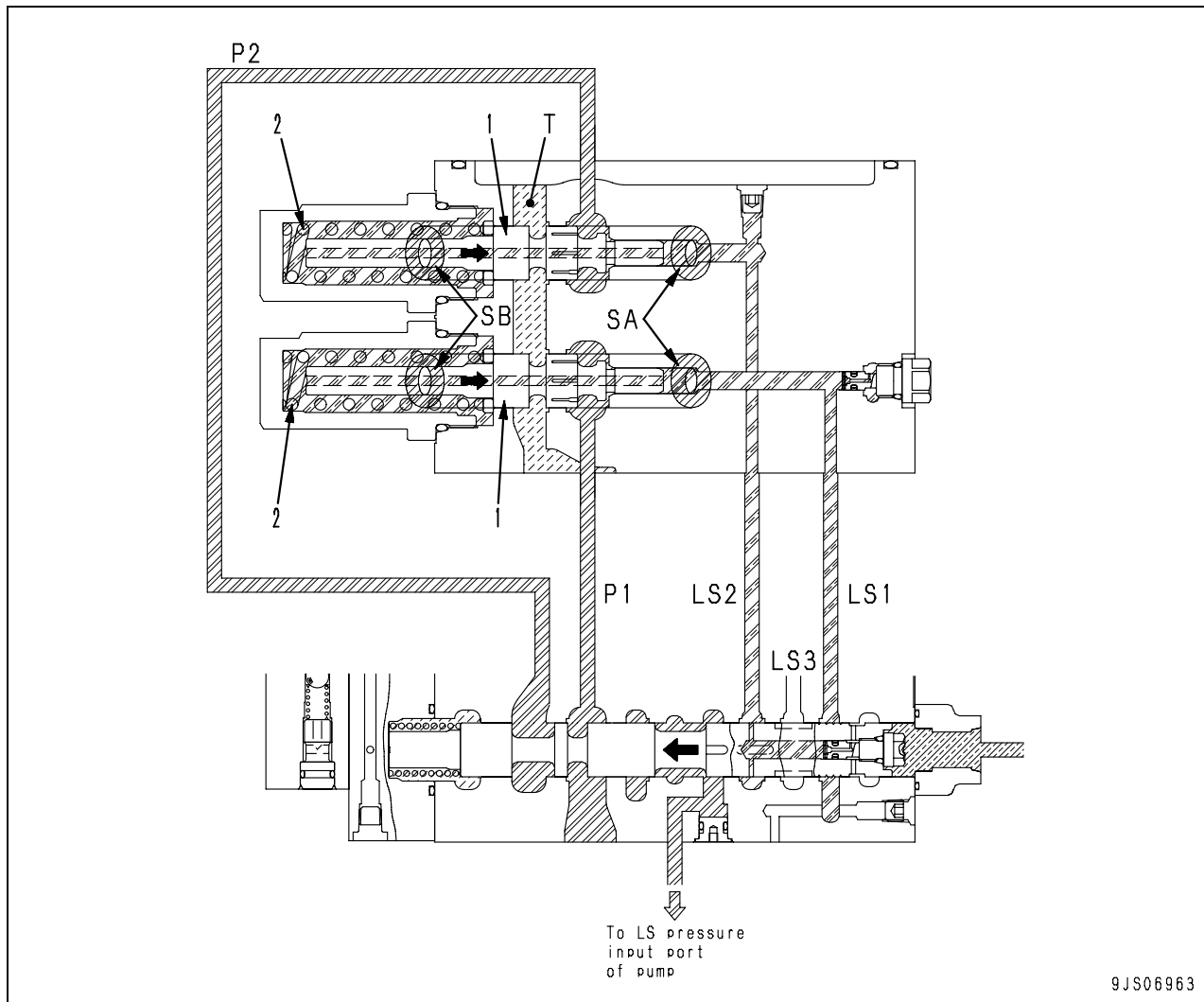
Function

- When any work equipment valve is operated if the demand flow for the actuator becomes greater than the pump discharge from the minimum swash plate angle, the oil flow to tank circuit (T) is cut off, and all pump discharge amount (Q) flows to the actuator circuit.
- Since the pump merge-divider valve is at the merge position, pump discharge pressures (P1) and (P2) are merged. LS pressures (LS1), (LS2), and (LS3) are also merged.

Operation

- When any work equipment valve is operated for a long stroke, LS pressures (LS1) and (LS2) are generated and act on the face (SB) of unload spool (1) [(P1) = (P2), (LS1) = (LS2)].
- For this reason, the difference between pump discharge pressure (P1) and (P2) and LS pressure (LS1) and (LS2) does not reach the load of spring (2), so spool (1) is pushed to the right by spring (2).
- As a result, pump discharge pressures (P1) and (P2) and tank circuit (T) are shut off, and all pump discharge amount (Q) flows to the actuator circuit.

3. During fine control of both travel valves



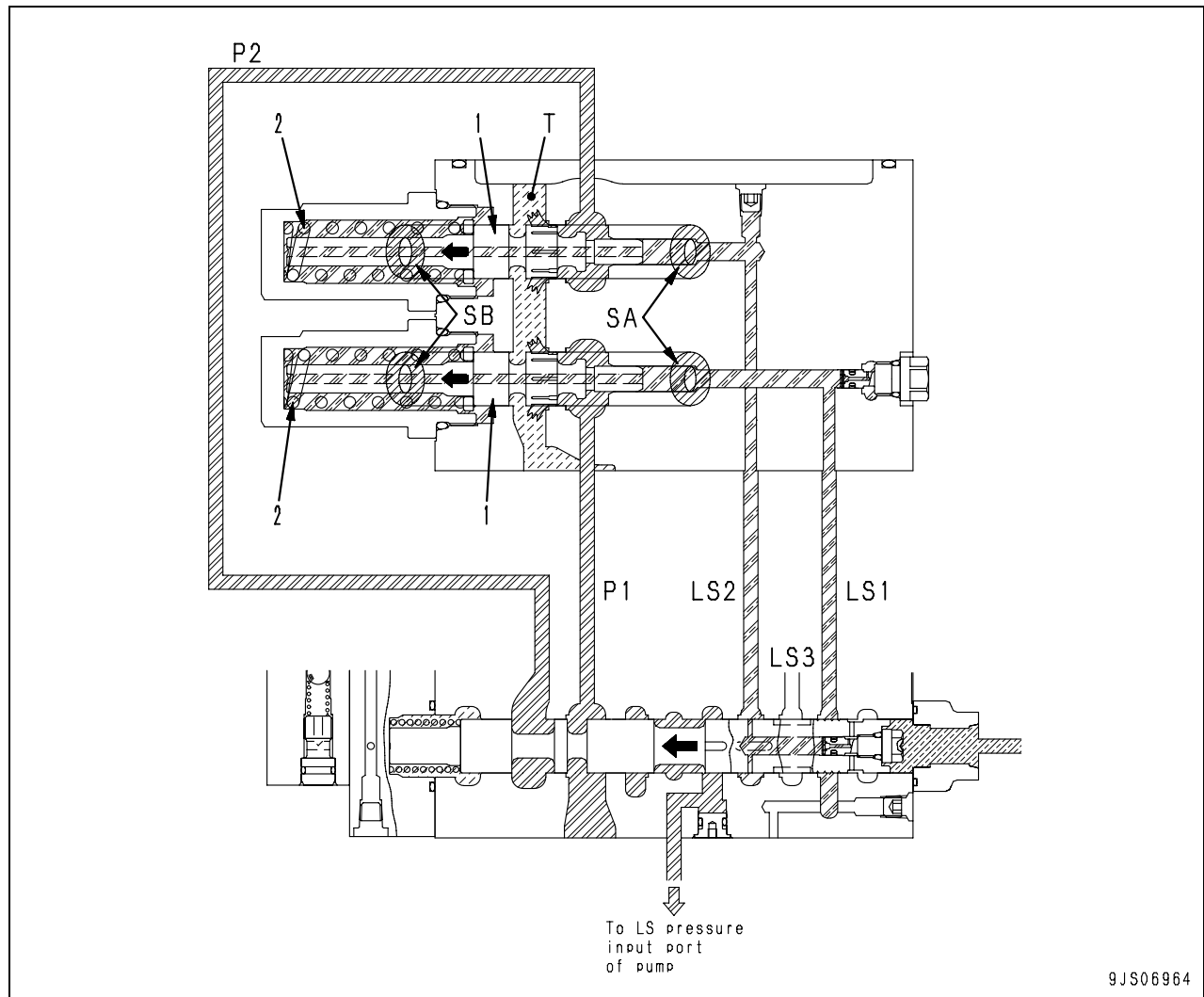
Function

- When the difference between pump discharge pressure (P1) and (P2) and LS pressure (LS1) and (LS2) reaches the load of spring (2), unload spool (1) opens, so excessive oil (maximum pump discharge mount - demand flow) flows into the tank circuit.
- Since the pump merge-divider valve is at the separate position, pump discharge pressures (P1) and (P2) are separated. LS pressures (LS1) and (LS2) are also separated.
- The swash plate angle of the pump becomes maximum, so the pump discharge amount becomes maximum. (For details, see the sections on the pump merge-divider valve.)

Operation

- When fine control is carried out on both travel valves, LS pressures (LS1) and (LS2) are generated and act on the face (SB) of spool (1) [(P1), (P2), (LS1), and (LS2) are separated].
- When this happens, the area of the opening of both travel valve spools is small, so LS pressures (LS1) and (LS2) are very different from pump discharge pressures (P1) and (P2).
- When the difference between pump discharge pressure (P1) and (P2) and LS pressure (LS1) and (LS2) reaches the load of spring (2), spool (1) moves to the left, and pump discharge pressures (P1) and (P2) are connected to tank circuit (T) and the excessive oil (maximum pump discharge mount - demand flow) flows.
- In other words, the excessive oil (maximum pump discharge mount - demand flow) above the strokes of both travel valves flows into tank circuit (T).

4. When both travel valves are operated



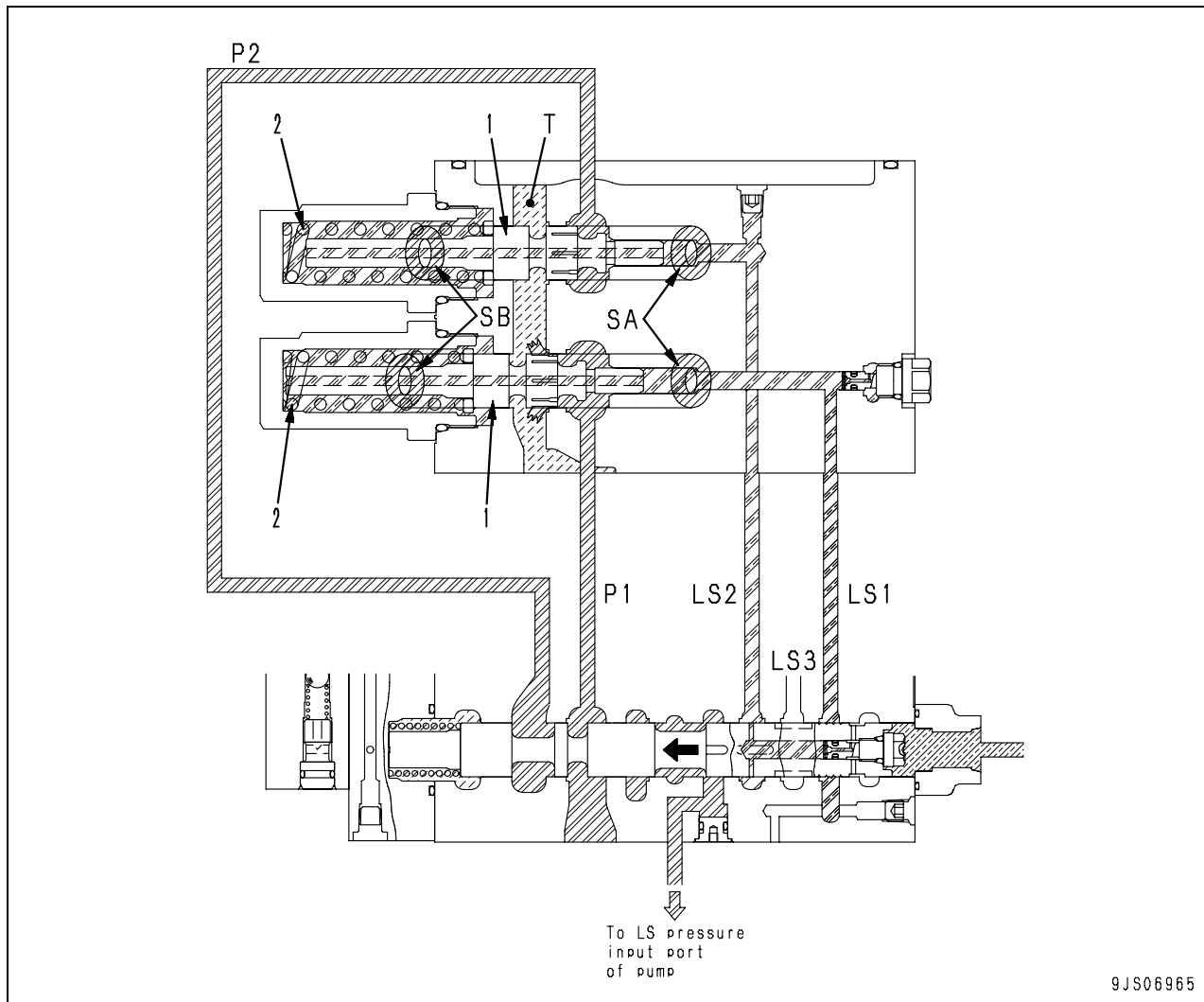
Function

- During operation of both travel valves, when the demand flow becomes maximum, the oil flow to tank circuit (T) is cut off, and all pump discharge amount (Q) flows to both travel circuits.
- Since the pump merge-divider valve is at the separate position, pump discharge pressures (P1) and (P2) are separated. LS pressures (LS1) and (LS2) are also separated.
- The swash plate angle of the pump becomes maximum, so the pump discharge amount becomes maximum. (For details, see the sections on the pump merge-divider valve.)

Operation

- When both travel valves are operated to the stroke ends, LS pressures (LS1) and (LS2) are generated and act on the face (SB) of unload spool (1) [(P1), (P2), (LS1), and (LS2) are separated].
- When this happens, the area of the openings of both travel valve spools is large, so LS pressures (LS1) and (LS2) are not so different from pump discharge pressures (P1) and (P2).
- For this reason, the difference between pump discharge pressure (P1) and (P2) and LS pressure (LS1) and (LS2) does not reach the load of spring (2), so spool (1) is pushed to the right by spring (2).
- As a result, pump discharge pressures (P1) and (P2) and tank circuit (T) are shut off, and all pump discharge amount (Q) flows to the actuator circuit.

5. When either travel valve is operated



Function

- The demand flow decided by the valve stroke is sent to the travel circuit on the operated travel valve side and the all pump discharge amount is sent to the tank circuit on the non-operated travel valve side.
- Since the pump merge-divider valve is at the separate position, pump discharge pressures (P1) and (P2) are separated. LS pressures (LS1) and (LS2) are also separated.
- The swash plate angle of the pump becomes maximum, so the pump discharge amount becomes maximum. (For details, see the sections on the pump merge-divider valve.)

Operation

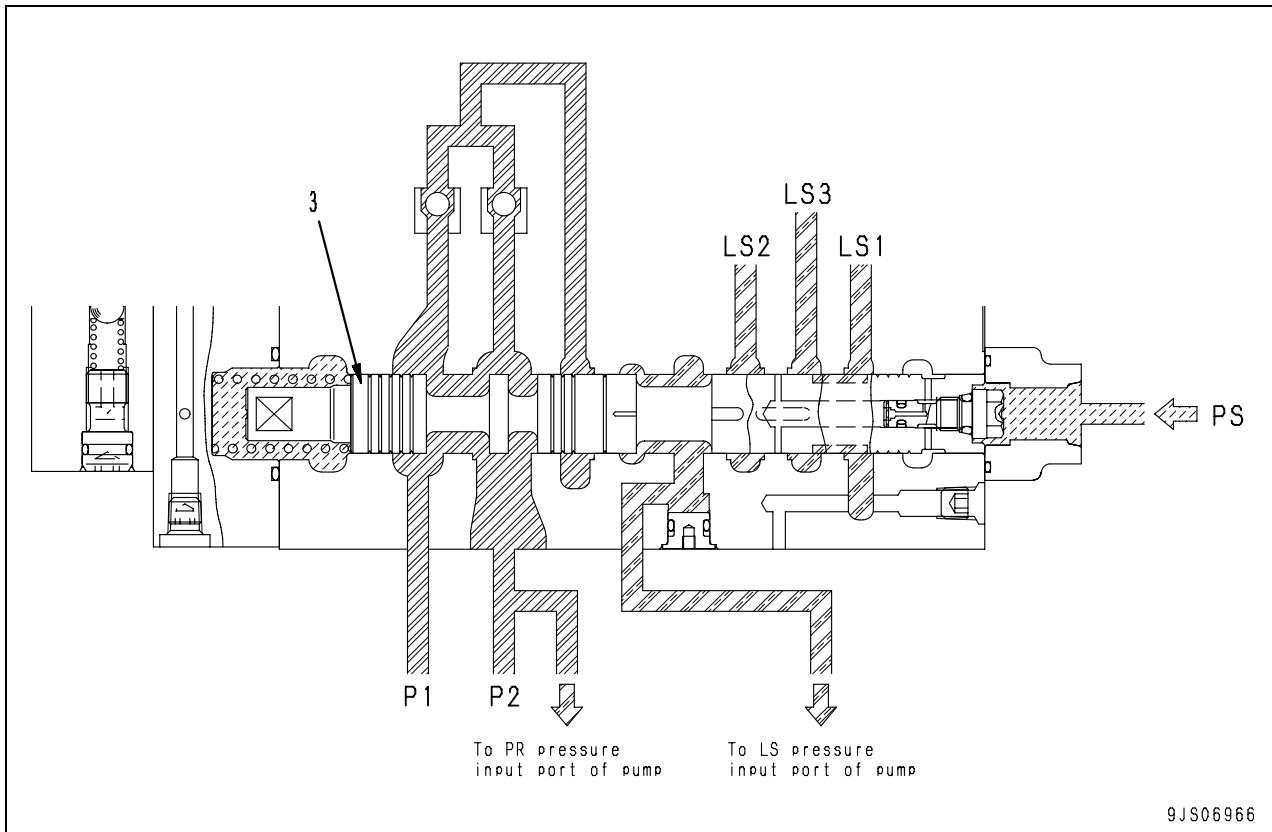
When left travel valve is operated to stroke end and right one is at HOLD.

- When the left travel valve is operated to the stroke end, LS pressure (LS1) is generated and acts on the face (SB) of unload spool (1).

- When this happens, the area of the openings of left travel valve spool is large, so LS pressures (LS1) is not so different from pump discharge pressures (P1).
- For this reason, the difference between pump discharge pressure (P1) and LS pressure (LS1) does not reach the load of spring (2), so spool (1) is pushed to the right by spring (2).
- As a result, pump discharge pressures (P1) and tank circuit (T) are shut off, and all pump discharge amount (QP1) on the (P1) side flows to the left travel circuit.
- Since the right travel valve is at HOLD, LS pressure (LS2) is not generated, so only pump discharge pressure (P2) acts.
- When pump discharge pressure (P2) reaches the load of spring (2), spool (1) moves to the left, and all pump discharge amount (QP2) on the (P2) side flows into tank circuit (T).

Merge-divider valve

1. When oil is merged: (PS) = 0 kg/cm²

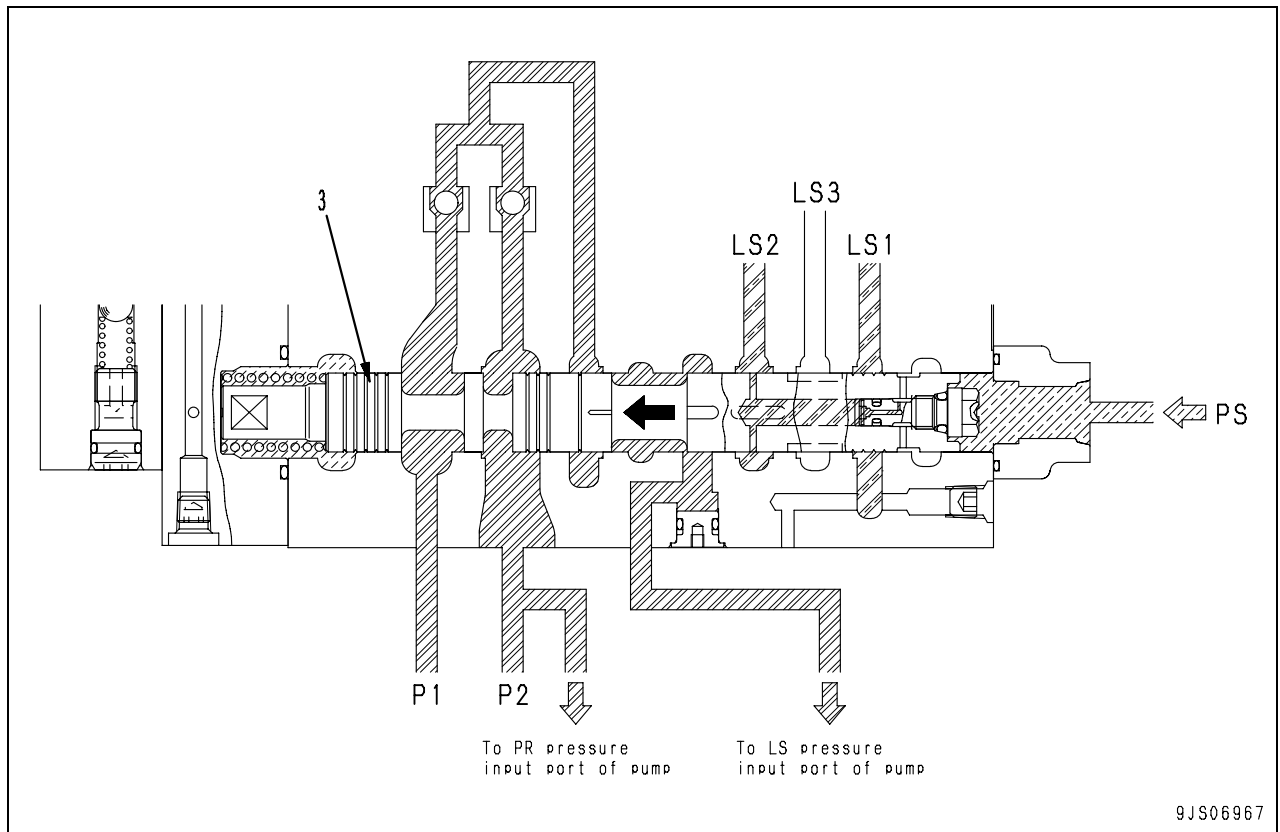


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Function

- Pump discharge pressures (P1) and (P2) are merged in pump merge-divider spool (3). (LS1), (LS2), and (LS3) are also merged.
- At this time, (P1) = (P2) and (LS1) = (LS2) = (LS3) and the pump swash plate is controlled by the difference between (P) and (LS).

2. When oil is divided: (PS) = 30 kg/cm²

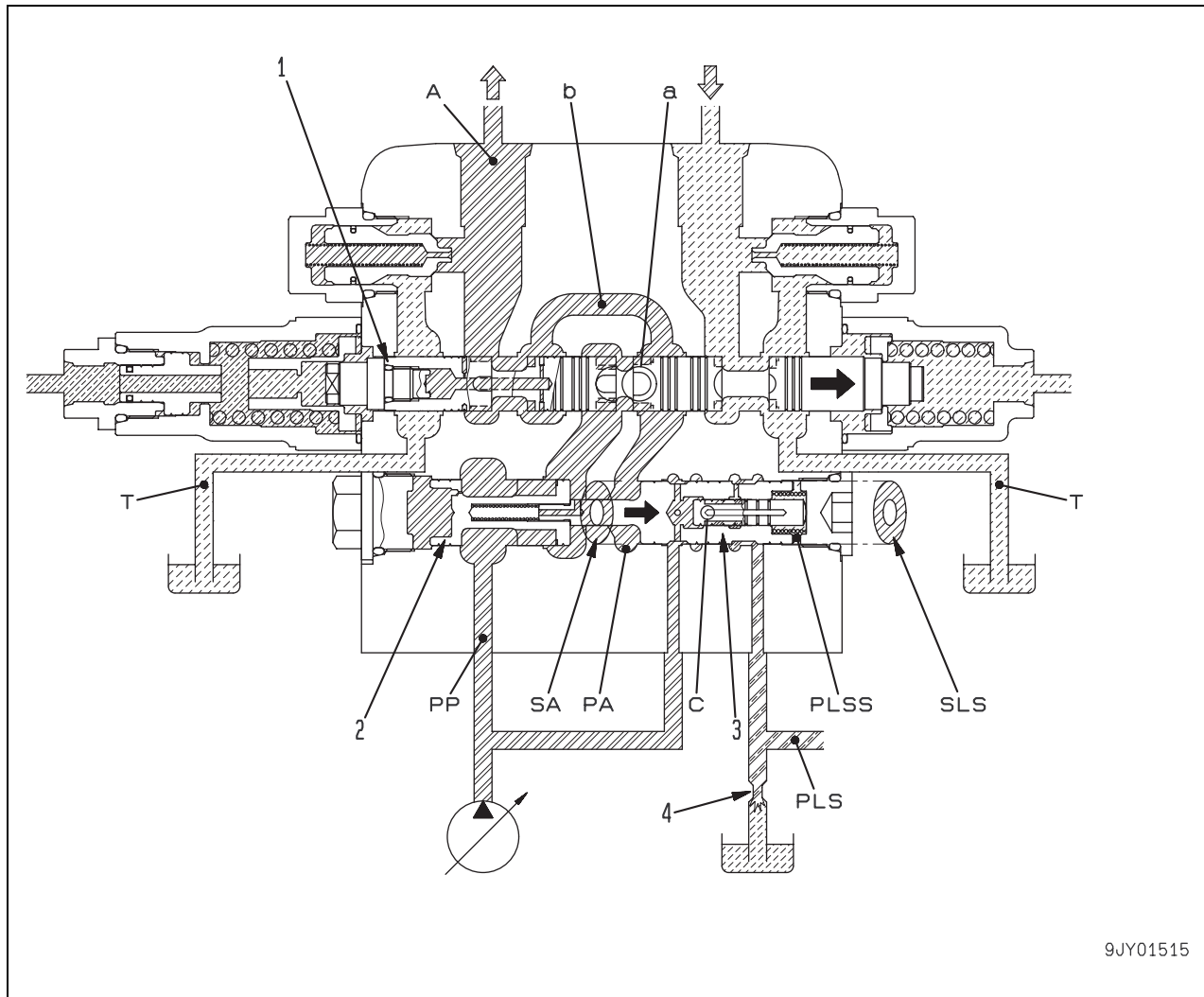


Function

- Pump discharge pressures (P1) and (P2) are divided in pump merge-divider spool (3). (LS1), (LS2), and (LS3) are also divided.
- At this time, higher one of (P1) and (P2) is applied through pump merge-divider spool (3) to the output port of the LS pressure.
- As a result, there is not difference between (P) and (LS) and the pump swash plate is set to the maximum position.

Introduction of LS pressure

1. Work equipment valve



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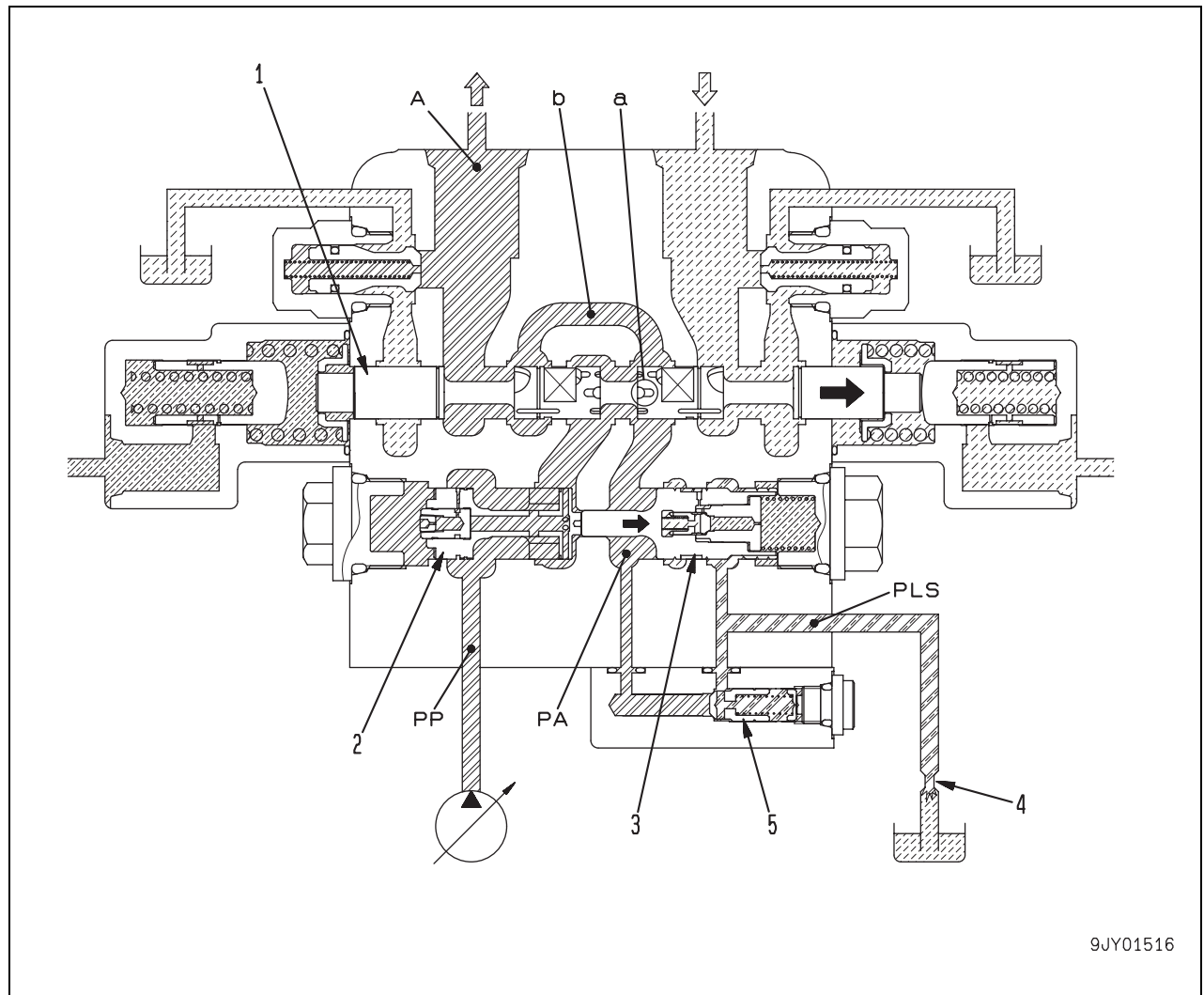
Function

- The LS pressure is the actuator load pressure at the outlet port end of the control valve.
- Actually, pump discharge pressure (PP) is reduced by reducing valve (3) of the pressure compensation valve to the same pressure as actuator circuit pressure (A) and sent to LS circuit (PLS).
- In the travel valve, actuator circuit pressure (A) is directly introduced to LS circuit (PLS).

Operation

- When spool (1) is operated, pump discharge pressure (PP) flows from flow control valve (2) through notch (a) in the spool and bridge passage (b) to actuator circuit (A).
- At the same time, reducing valve (3) also moves to the right, so pump discharge pressure (PP) is reduced by the pressure loss at notch (c). It goes to LS circuit (PLS), and then goes to spring chamber (PLSS).
- When this happens, LS circuit (PLS) is connected to tank circuit T from LS bypass plug (4) (See the section on the LS bypass plug).
- The areas at both ends of reducing valve (3) are the same [(SA) = (SLS)], and actuator circuit pressure (PA) acts on the (SA) end. The reduced pump discharge pressure (PP) acts on (SLS) at the other end.
- As a result, reducing valve (3) is balanced at a position where actuator circuit pressure (PA) and the pressure of spring chamber (PLSS) are the same. Pump discharge pressure (PP) reduced at notch (c) becomes actuator pressure (A) and is introduced into LS circuit (PLS).

2. Travel valve



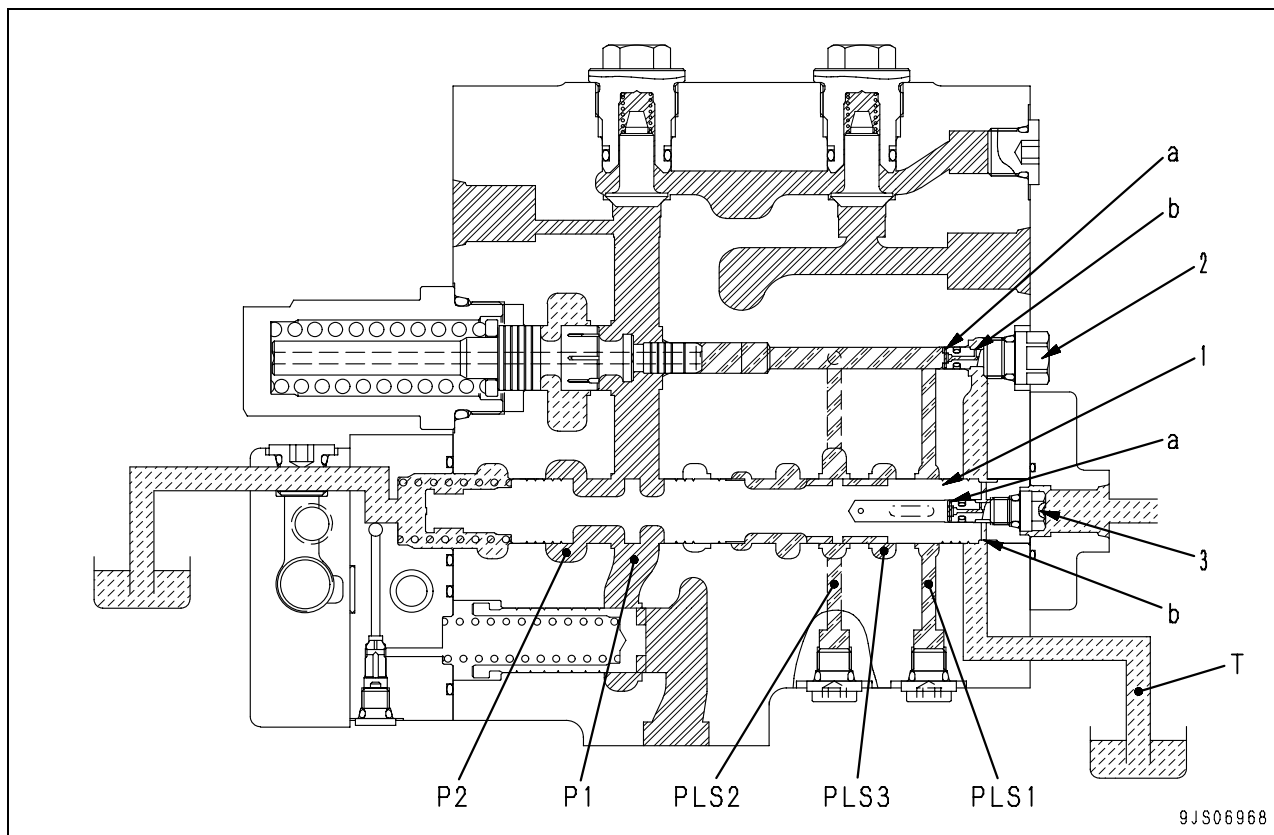
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Operation

- When spool (1) is operated, pump discharge pressure (PP) flows from flow control valve (2) through notch (a) in the spool and bridge passage (b) to actuator circuit (A).
 - Actuator circuit pressure (PA) (= A) is introduced through the check valve (5) into LS circuit (PLS).
- ★ The travel circuit is different from the work equipment circuit: actuator circuit pressure (PA) is directly introduced into LS circuit (PLS).

LS bypass plug

1. When work equipment valve is operated (including compound operation of work equipment + travel)



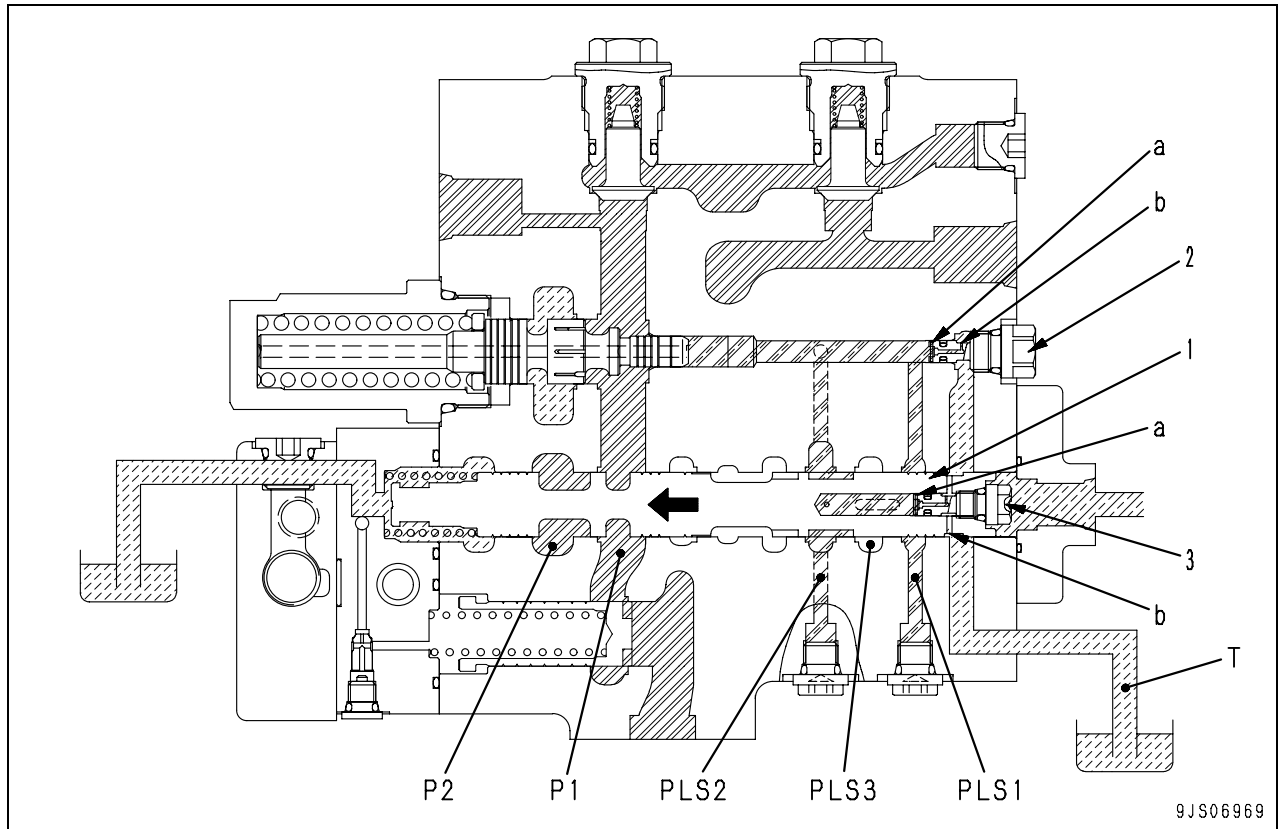
Function

- The LS bypass plug releases the residual pressure of LS pressure (PLS).
- This lowers the rising speed of LS pressure (PLS). In addition, the discarded throttled flow causes a pressure loss in the throttled flow in the reducing valve, and that lowers the effective LS differential pressure to improve the stability.

Operation

- Since pump merge-divider spool (1) is at the merge position, the hydraulic oil in LS circuits (PLS1), (PLS2), and (PLS3) flows from tip filter (a) of LS bypass plug (2) on the (P1) side through orifice (b) to tank circuit (T).

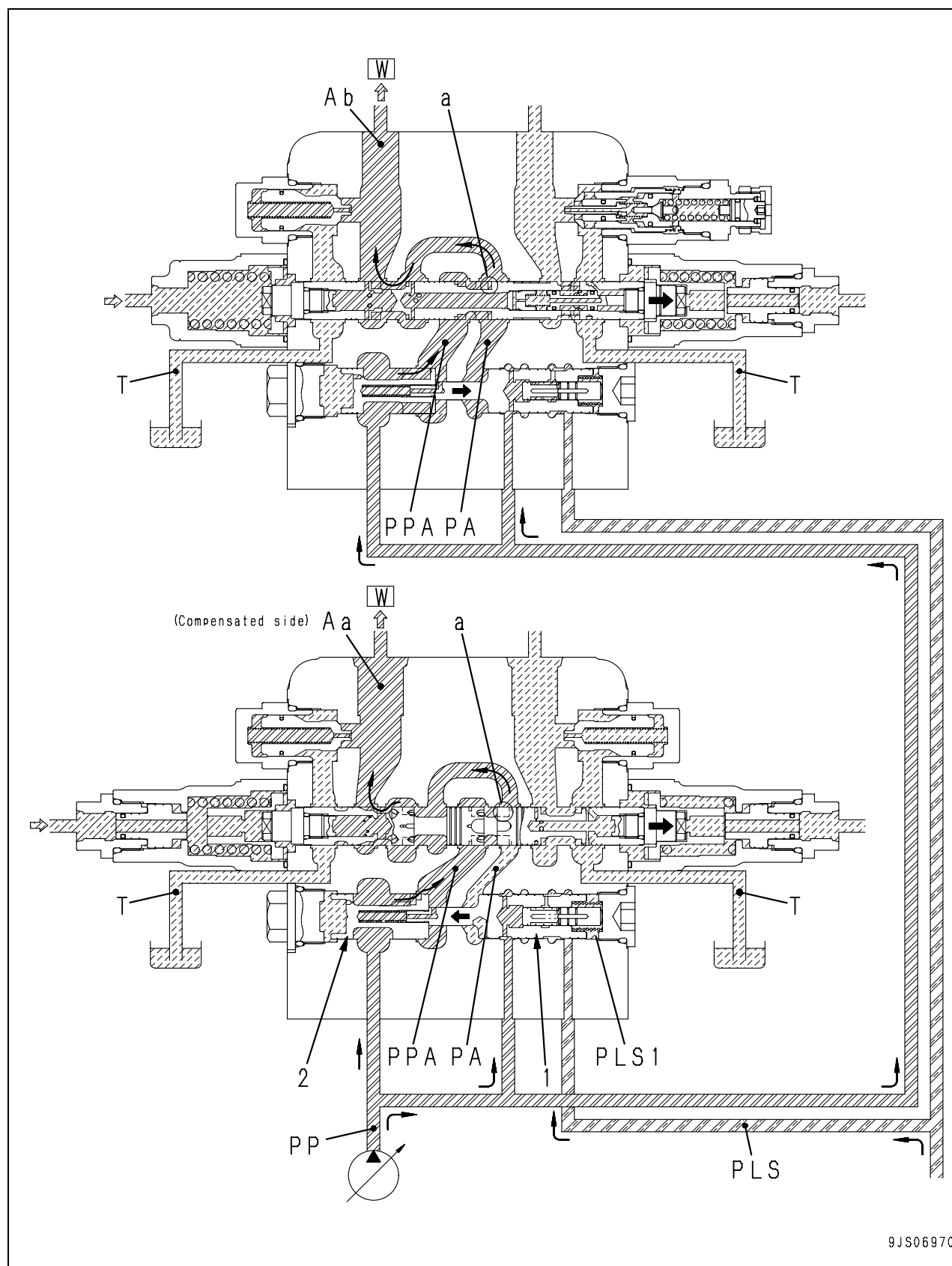
2. When either or both travel valves are operated (Including operation of only one travel valve)



Operation

- Since pump merge-divider spool (1) is at the separate position, LS circuits (PLS1) and (PLS2) are separated.
- The hydraulic oil (PLS1) flows from tip filter (a) of LS bypass plug (2) on the (P1) side through orifice (b) to tank circuit (T).
- The hydraulic oil (PLS2) flows from tip filter (a) of LS bypass plug (3) on the (P2) side through orifice (b) to tank circuit (T).

Pressure compensation valve



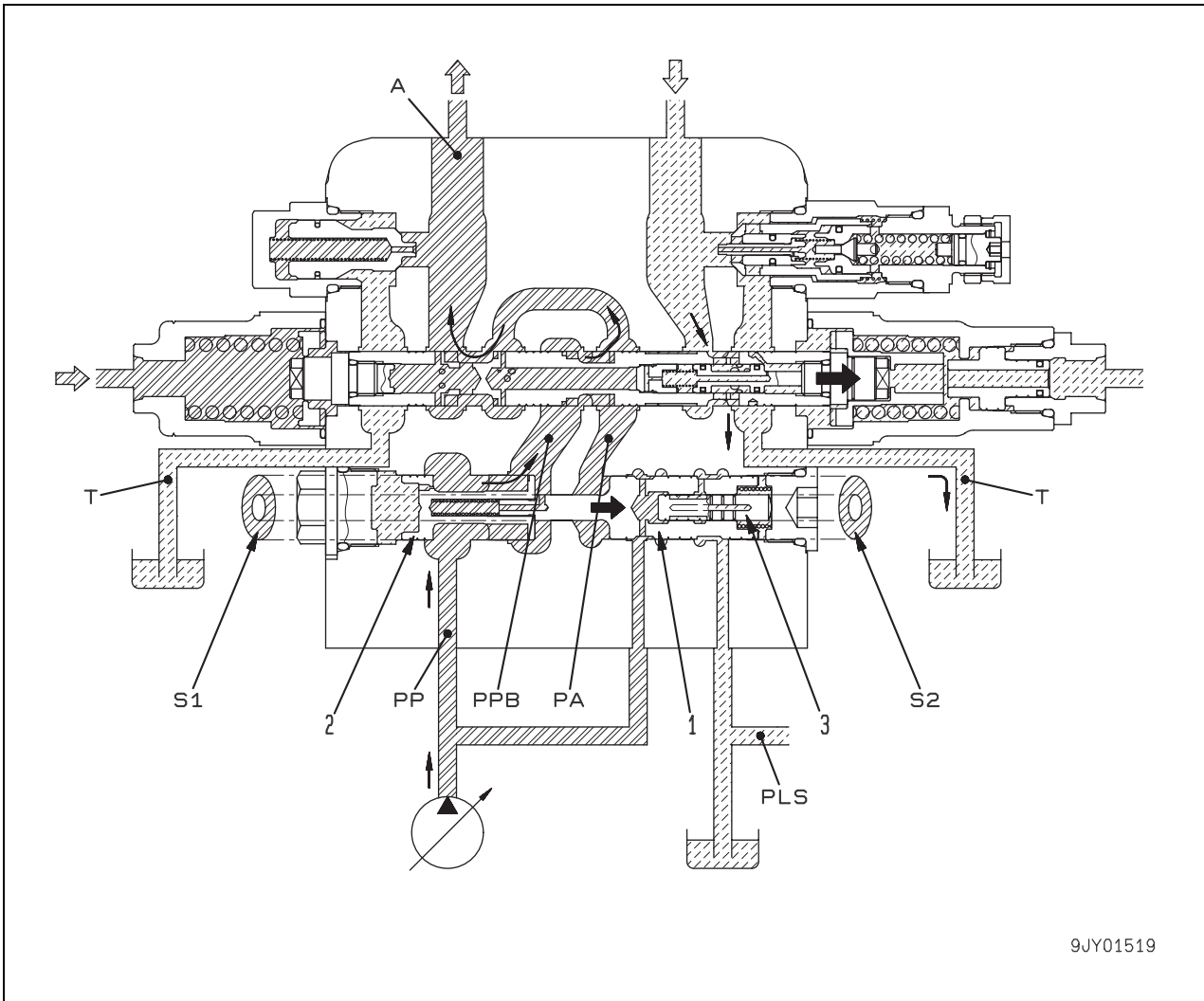
Function

- When the load pressure becomes lower than another actuator and the flow is going to increase during a compound operation, this valve compensates the load pressure. [At the time, the load pressure of another actuator under compound operation (the upper side) is higher than that of the actuator on this side (the lower side)].

Operation

- When the load pressure (A_b) of another actuator side (the upper side) rises during a compound operation, the flow in the actuator circuit (A_a) on this side (the lower side) is apt to increase.
- In this case, the LS pressure (PLS) of another actuator is applied to the spring chamber (PLS1) and pushes the pressure reducing valve (1) and the flow control valve (2) to the left side.
- The flow control valve (2) throttles the opening area between the pump circuit (PP) and the spool upstream (PPA) and causes a pressure loss between (PP) and (PPA).
- The flow control valve (2) and the pressure reducing valve (1) balance each other where the pressure difference between (PA) applied to the both end faces of the pressure reducing valve (1) and (PLS) becomes the same as the pressure loss between (PP) before and after the flow control valve (2) and (PPA).
- So, the pressure differences between the upstream pressures (PPA) and the downstream pressures (PA) of the both spools under compound operation become the same, and the pump flow is distributed in proportion to the opening area of each spool notch (a).

Area ratio of pressure compensation valve



Function

- The pressure compensation valve slightly adjust the ratio (S2) and (S1) of the area (S1) on the left side of the flow control valve (2) and the area (S2) on the right side of the pressure reducing valve (1) to suite the characteristics of each actuator and determines the compensation characteristics.

S1 : Area of the flow control valve (2) – area of the piston (3)

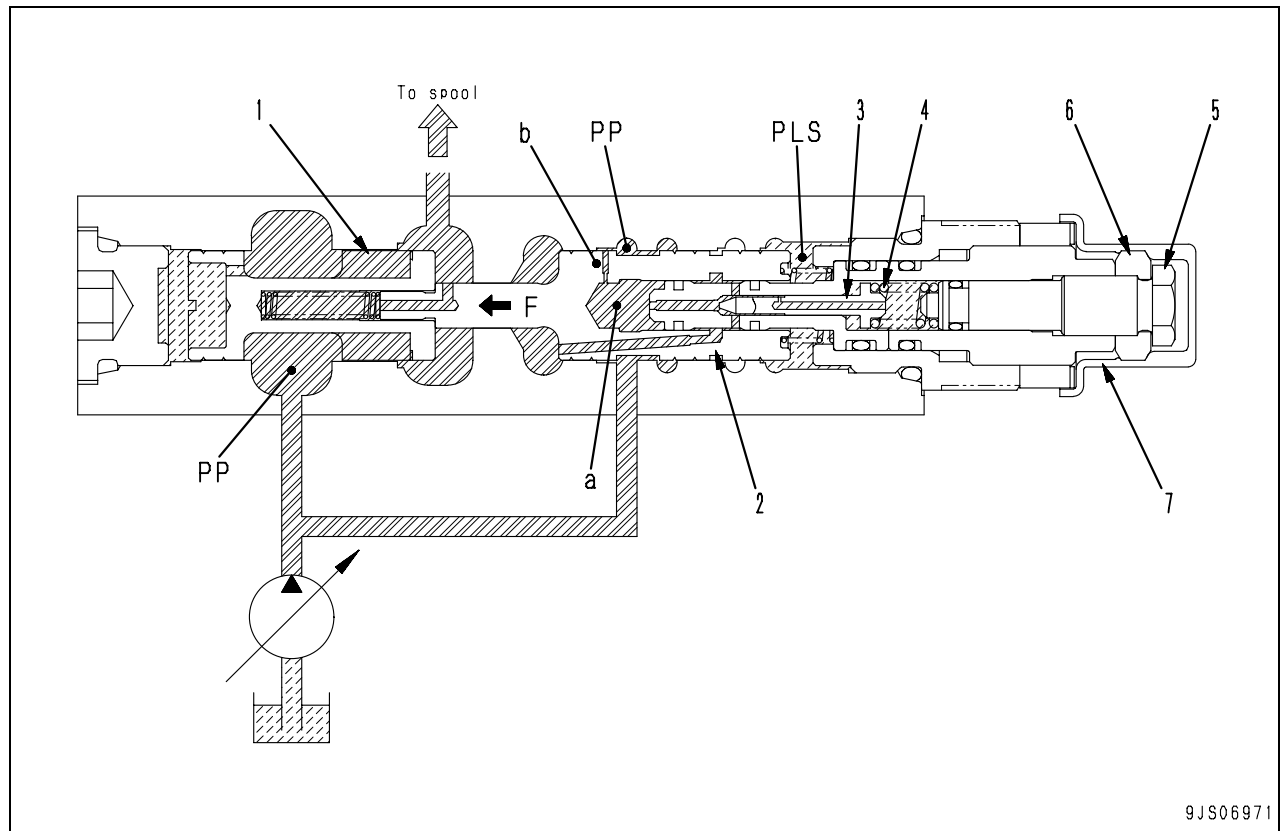
S2 : Area of the pressure reducing valve (1) – area of the piston (3)

Area ratio (S1) : (S2) and compensation characteristics

- When the ratio is 1.00 :
The expression [Pump (discharge) pressure (PP) – Spool notch upstream pressure (PPB)] [LS circuit pressure (PLS) – Actuator circuit pressure (PA) (= A)] can be held, and the flow is distributed as per the spool opening area ratio.
- When the ratio is more than 1.00:
The expression (PP) – (PPB) > (PLS) – (PA) (= A) can be held, and the flow is distributed less than the spool opening area ratio.
- When the ratio is less than 1.00:
The expression (PP) – (PPB) < (PLS) – (PA) (= A) can be held, and the flow is distributed more than the spool opening area ratio.

Variable pressure compensation valve (for service valve)

In case of compound operation with high load work equipment (like boom RAISE)



1. Flow control valve
2. Pressure reducing valve
3. Poppet
4. Spring

5. Screw
6. Lock nut
7. Polyethylene cap

Function

- In compound operation of the service valve (for attachment) and work equipment valve like boom RAISE, this variable pressure compensation valve can adjust flow distribution to the service valve. (The equivalent area ratio is variable.)
- Spring (4) force can be adjusted with the screw (5).

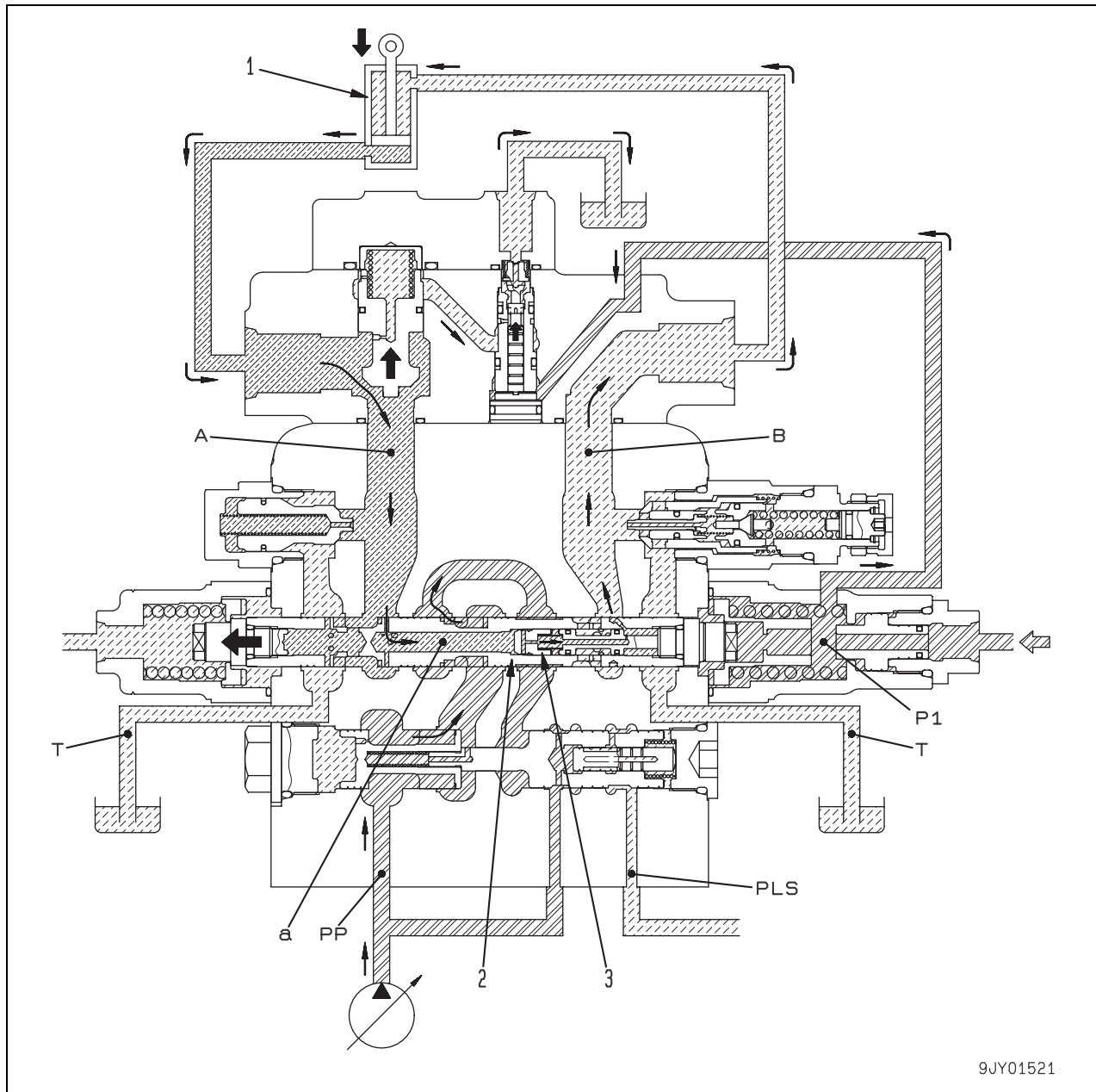
- Therefore, the force (F), which is required for the pressure reducing valve (2) to close the flow control valve (1), becomes smaller.
- This means that the flow control valve (1) moves in the right direction and the flow from the pump to the service valve increases just like the area ratio has reduced.

Operation

- The pump discharge pressure (PP) and the LS pressure (PLS) depends on other work equipment.
- When the pressure in the (a) chamber reaches the set pressure of the spring (4), the poppet (3) will open, and the throttle (b) maintains the pressure in the (a) chamber below the pump discharge pressure (PP).

Boom regeneration circuit

1. At boom lower and own weight fall



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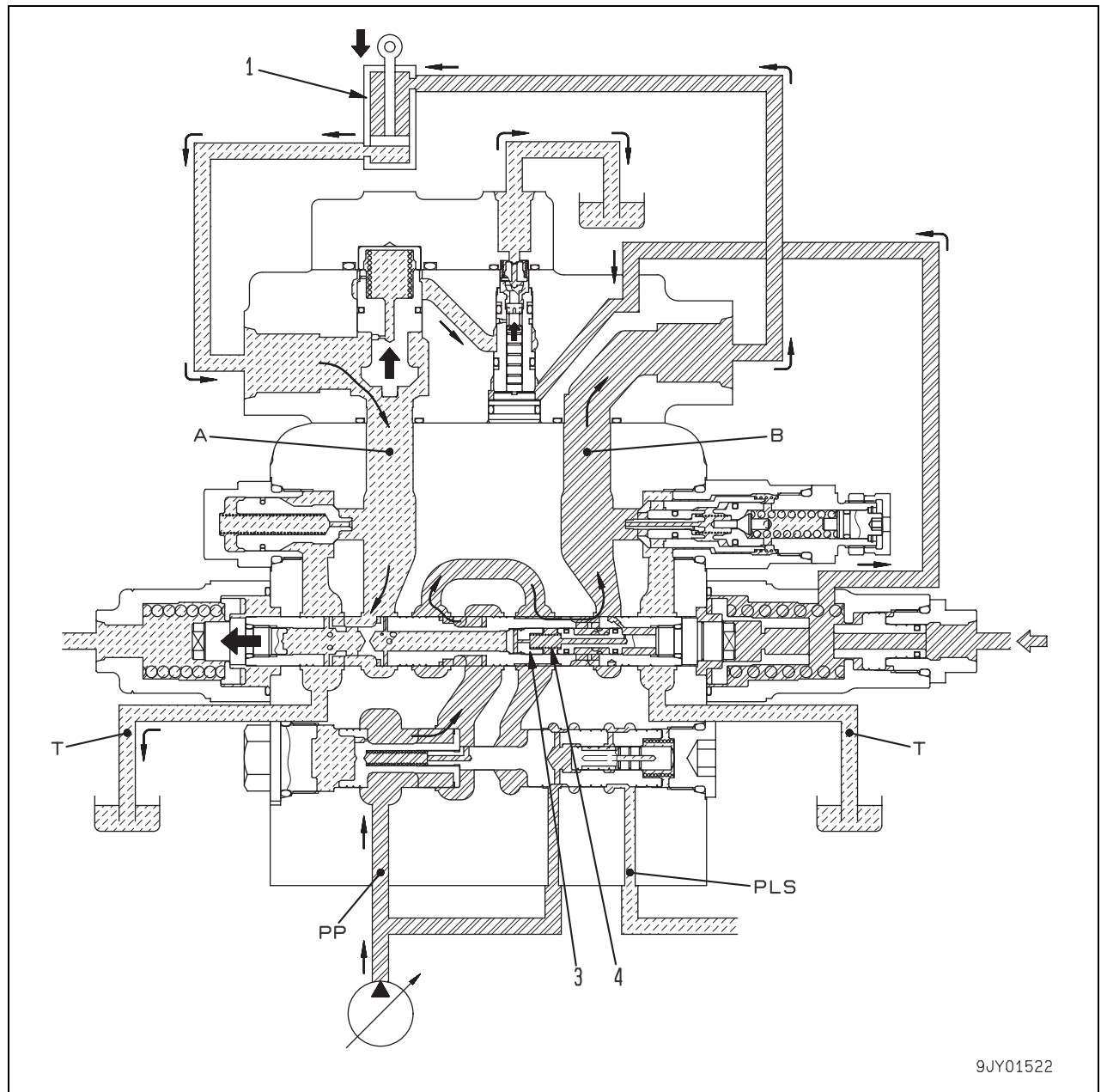
Function

- When the boom is lowered and falls due to its own weight because the bottom pressure (A) in the cylinder (1) is higher than the head pressure (B), this circuit brings the return flow on the bottom side to the head side to increase the cylinder speed.
- At the time, part of the return flow on the bottom side passes through the regeneration passage (a) of the boom spool (2), pushes the check valve (3) to open it and flows to the head side.
- This increases the boom lower speed.

Operation

- When the boom is lowered and falls due to its own weight, the bottom side pressure (A) in the boom cylinder (1) will rise above the head side pressure (B).

2. At boom lower load process



Function

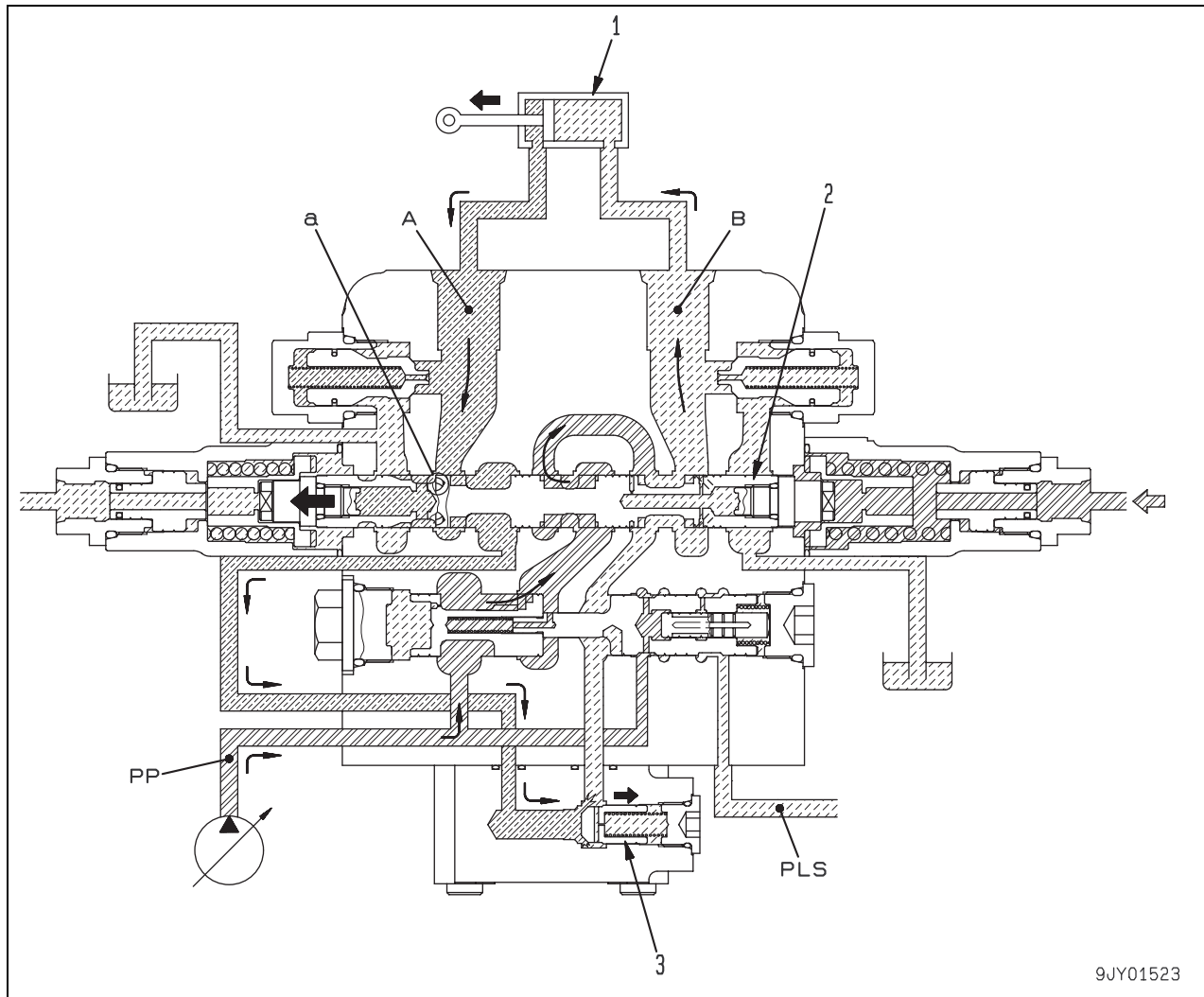
- When the head pressure (B) of the cylinder (1) is higher than the bottom pressure (A) while the boom is lowered and the boom is in the load process, the check valve (3) will be closed, and the circuits on the head side and the bottom side will be interrupted.
- At the time, the head side pressure (B) and the spring (4) close the check valve (3), and the circuits on the head side and the bottom side are interrupted.

Operation

- When the boom is lowered and is in the load process, the head side pressure (B) of the boom cylinder (1) rises above the bottom side pressure (A).

Arm regeneration circuit

1. At arm in and own weight fall



A : Head circuit
B : Bottom circuit
PP : Pump circuit

1. Arm cylinder
2. Arm spool
3. Check valve

Function

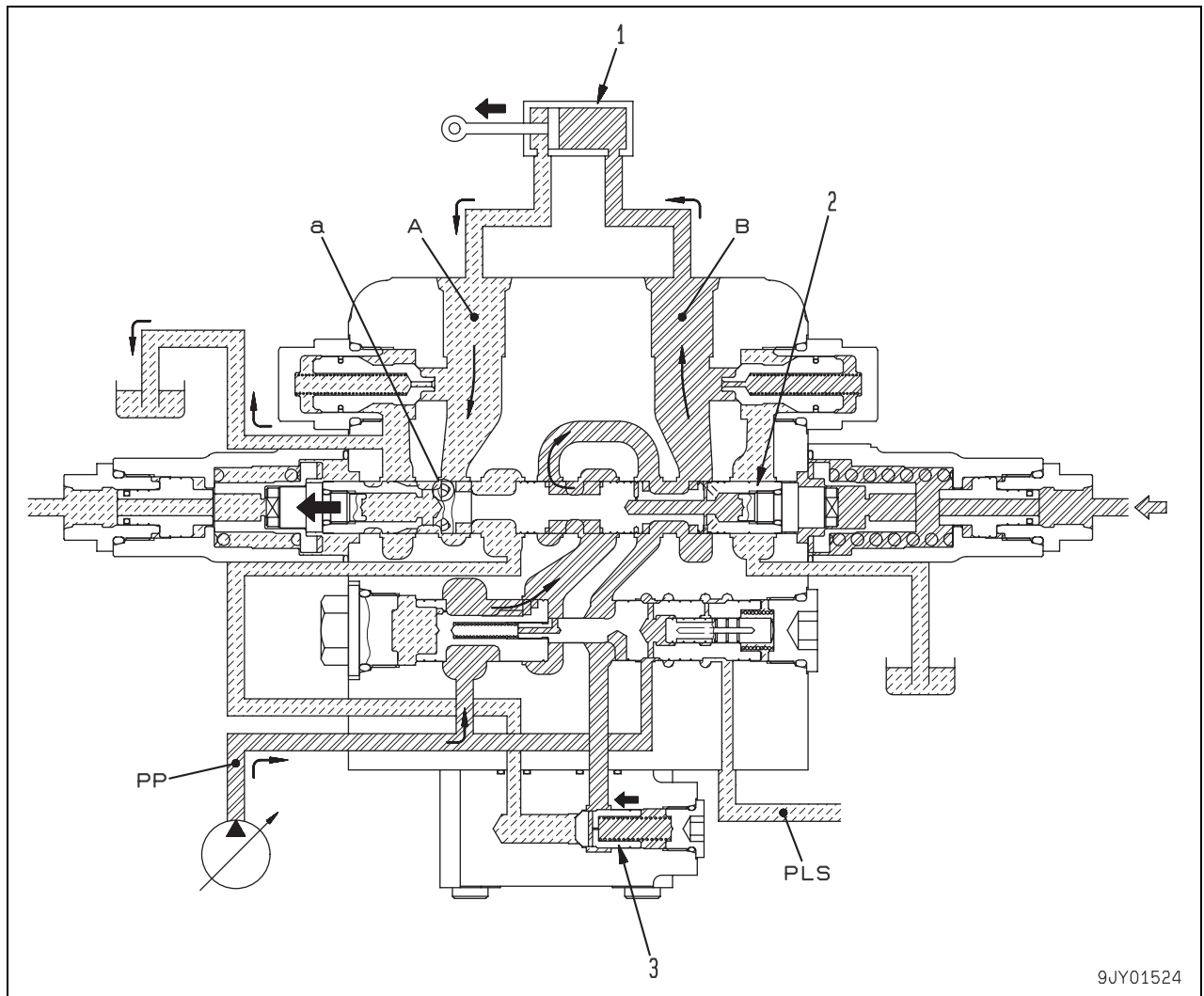
- When the arm falls due to its own weight because the head pressure (A) in the arm cylinder (1) is higher than the bottom pressure (B) during arm digging, this circuit brings the return flow on the head side to the bottom side to increase the cylinder speed.

- At the time, part of the return flow on the head side passes through the regeneration passage (a) of the arm spool (2), pushes the check valve (3) to open it and flows to the bottom side.
- This increases the arm digging speed.

Operation

- When the arm falls for digging due to its own weight, the head side pressure (A) in the arm cylinder (1) will rise above the bottom side pressure (B).

2. At arm in process



A : Head circuit
B : Bottom circuit
PP : Pump circuit

1. Arm cylinder
2. Arm spool
3. Check valve

Function

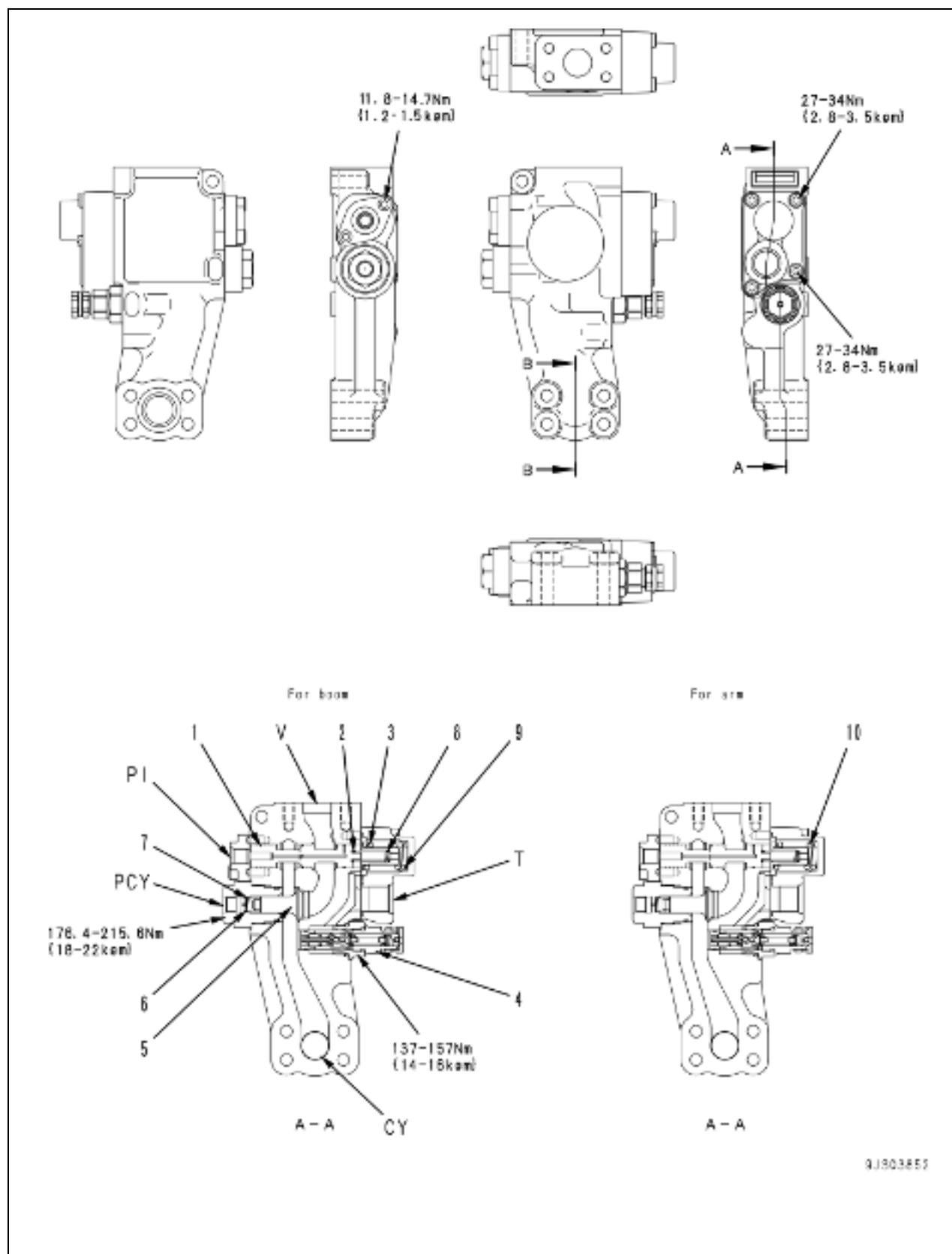
- When the bottom pressure (B) of the cylinder (1) rises above the head pressure (A) and the arm enters the digging process, the check valve (3) will be closed and the circuits on the head side and the bottom side will be interrupted.

Operation

- When the arm is in the digging process, the bottom side pressure (B) of the arm cylinder (1) will rise, close the check valve (3) and interrupt the circuits on the head side and the bottom side.

Hydraulic drift prevention valve

(For the boom and arm)



CY: To work equipment cylinder
 PCY: For pressure pickup port and equalizer circuit
 PI: From PPC valve
 T: To tank
 V: From control valve

1. Pilot spool
2. Spool (1st stage spool)
3. Spring (2nd stage spool)
4. Safety valve
5. Check valve
6. Spring

Unit: mm

No.	Check item	Criteria					Remedy
7	Check valve spring	Standard size			Repair limit		If damaged or deformed, replace spring.
		Free length x Outside diameter	Installed length	Installed load	Free length	Installed load	
		24.5 x 11.6	18.0	4.9 N {0.5 kg}	—	3.9 N {0.45 kg}	
8	Spool return spring	31.75 x 8.5	25.0	29.4 N {3.0 kg}	—	23.5 N {2.7 kg}	
9	Spool return spring	30.41 x 20.6	29.0	51.35 N {5.24 kg}	—	41.0 N {4.2 kg}	
10	Spool return spring	30.41 x 20.6	29.0	51.35 N {5.24 kg}	—	41.0 N {4.2 kg}	

Function

- Prevents the pressurized oil from reversing from the work equipment cylinder and the latter from a sudden drop if the piping bursts between the control valve and the work equipment cylinder.

Operation

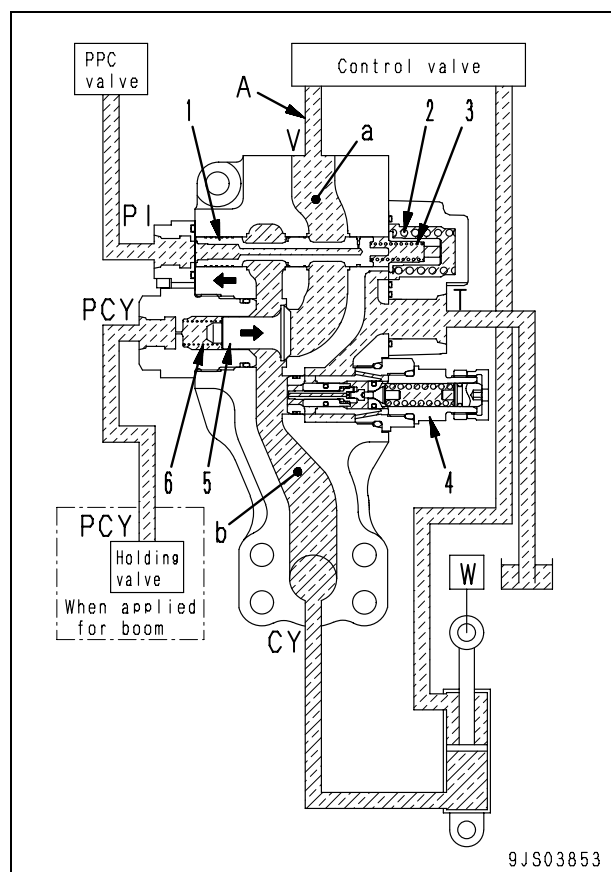
1. When the work equipment lever is in neutral

When the piping is free of burst

- Check valve (5) is closed under the holding pressure of the cylinder led from port (CY) to chamber (b).
- Pilot pressure led to port (PI) from the PPC valve when in neutral is 0 kg/cm².
- Spool (1) is pressed to the left by the force of springs (2) and (3).
- Chambers (a) and (b) are shut off.
- No pressurized oil flows between the control valve and the work equipment cylinder.
- Accordingly, the work equipment is held in position.
- If the work equipment cylinder has abnormally high pressure, safety valve (4) is actuated by the holding pressure of the work equipment cylinder.
- Chambers (b) of L.H. and R.H. hydraulic drift prevention valve for the boom are interconnected by port (PCY).
- Chambers (b) will have the same pressure if the L.H. and R.H. hydraulic drift prevention valves have a difference in leakage.

If the piping bursts

- If piping (A) bursts between the control valve and the work equipment cylinder, chambers (a) and (b) are shut off same as when the piping has no burst.
- Pressure for the work equipment cylinder is held to prevent a sudden drop of the work equipment.



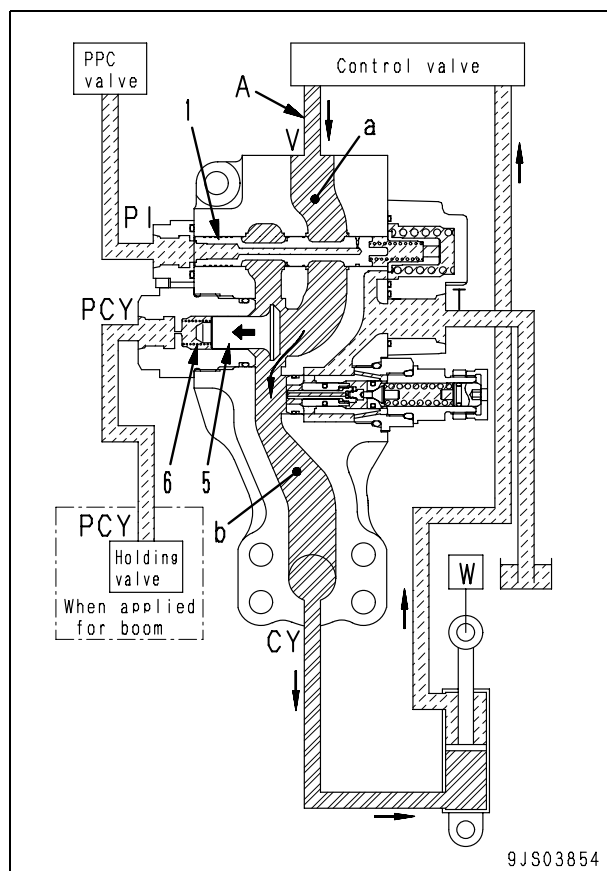
2. When pressurized oil flows from the main valve to the cylinder

When the piping is free of burst

- Pressurized oil led to chamber (a) from the control valve becomes higher than the combined force of pressure from work equipment cylinder circuit chamber (b) and spring (6).
- Check valve (5) opens and chambers (a) and (b) are interconnected.
- Pressurized oil flows from the control valve to the work equipment cylinder.

If the piping bursts

- If piping (A) bursts between the control valve and the work equipment cylinder, pressurized oil in chamber (a) flows outside from the burst portion.
- Pressure force in chamber (a) drops.
- Pressure force in chamber (a) drops lower than the combined pressure force of chamber (b) and spring (6).
- Check valve (5) closes and chambers (a) and (b) are cut off.
- Pressure for the work equipment cylinder is held to prevent a sudden drop of the work equipment.



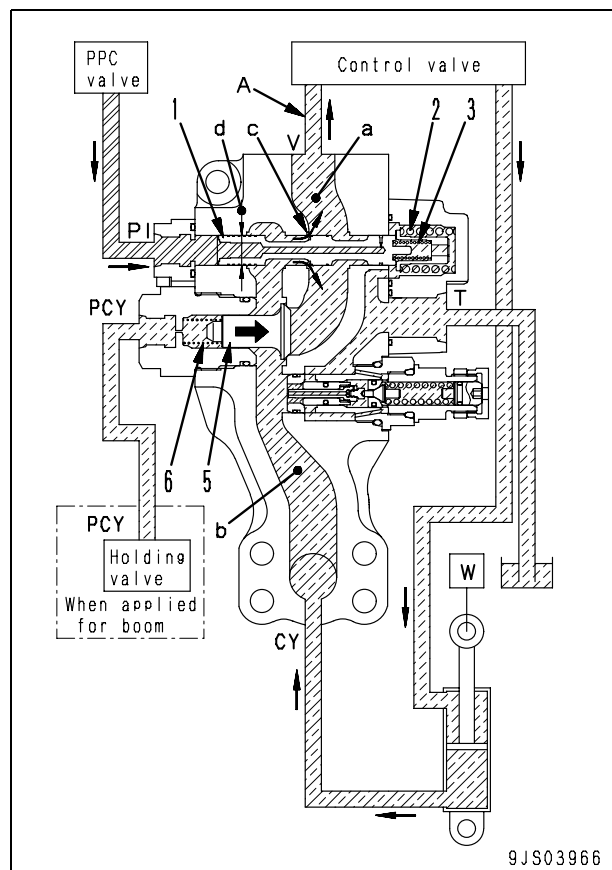
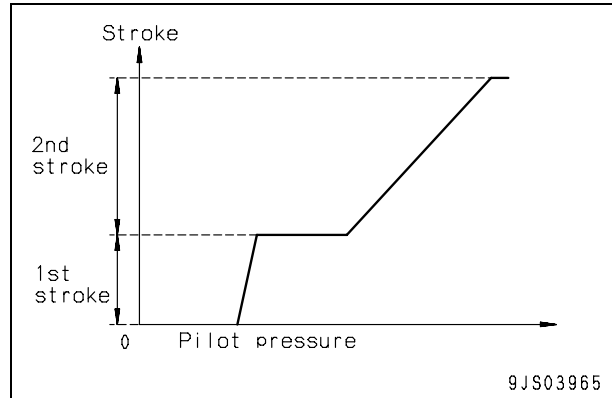
3. When returning pressurized oil to the main valve from the work equipment cylinder

When the piping is free of burst

- Holding pressure of the work equipment cylinder is led to chamber (b) and check valve (5) closes.
- Pilot pressure from the PPC valve is led to port (PI) and reaches [Pilot Pressure > Force of Spring (3)] (area of d).
- Spool (1) moves to the right to the stand-by position. (1st stage stroke)
- At this point, chambers (a) and (b) are not interconnected.
- Pilot pressure further rises, and reaches [Pilot pressure > Force of spring (2)] (area of d).
- Spool (1) moves further to the right, and chambers (a) and (b) are interconnected. (2nd stage stroke)
- Pressurized oil returns to the control valve from the work equipment cylinder.

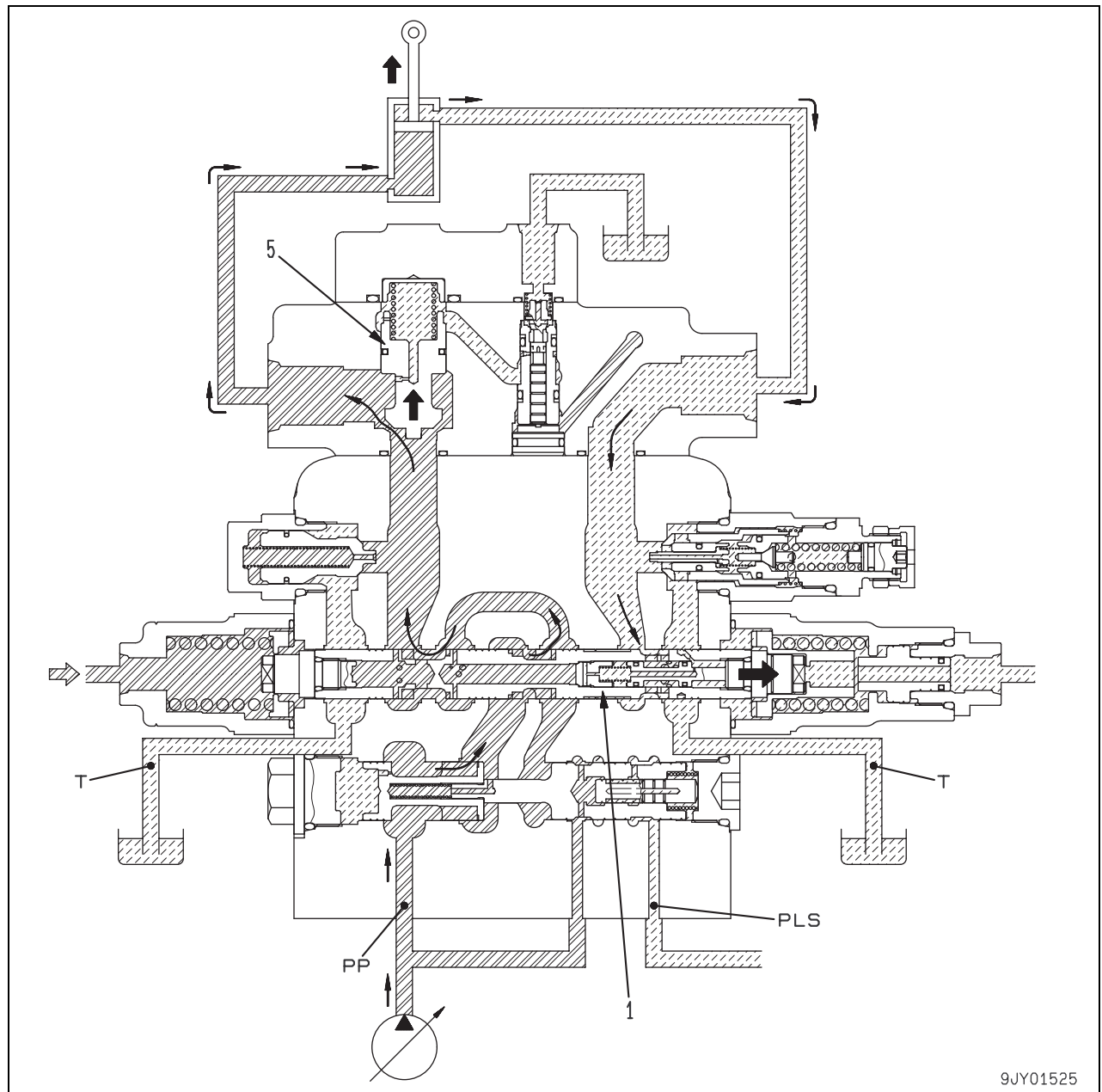
If the piping bursts

- If piping (A) bursts between the control valve and the work equipment cylinder.
- Pressurized oil in chamber (a) flows out to the burst portion but resupplied from chamber (b).
- Since pressurized oil flows via opening (c) of spool (1), a sudden drop of the cylinder is prevented.



Hydraulic drift prevention valve (Boom and arm)

1. When boom is raised and arm is moved out



9JY01525

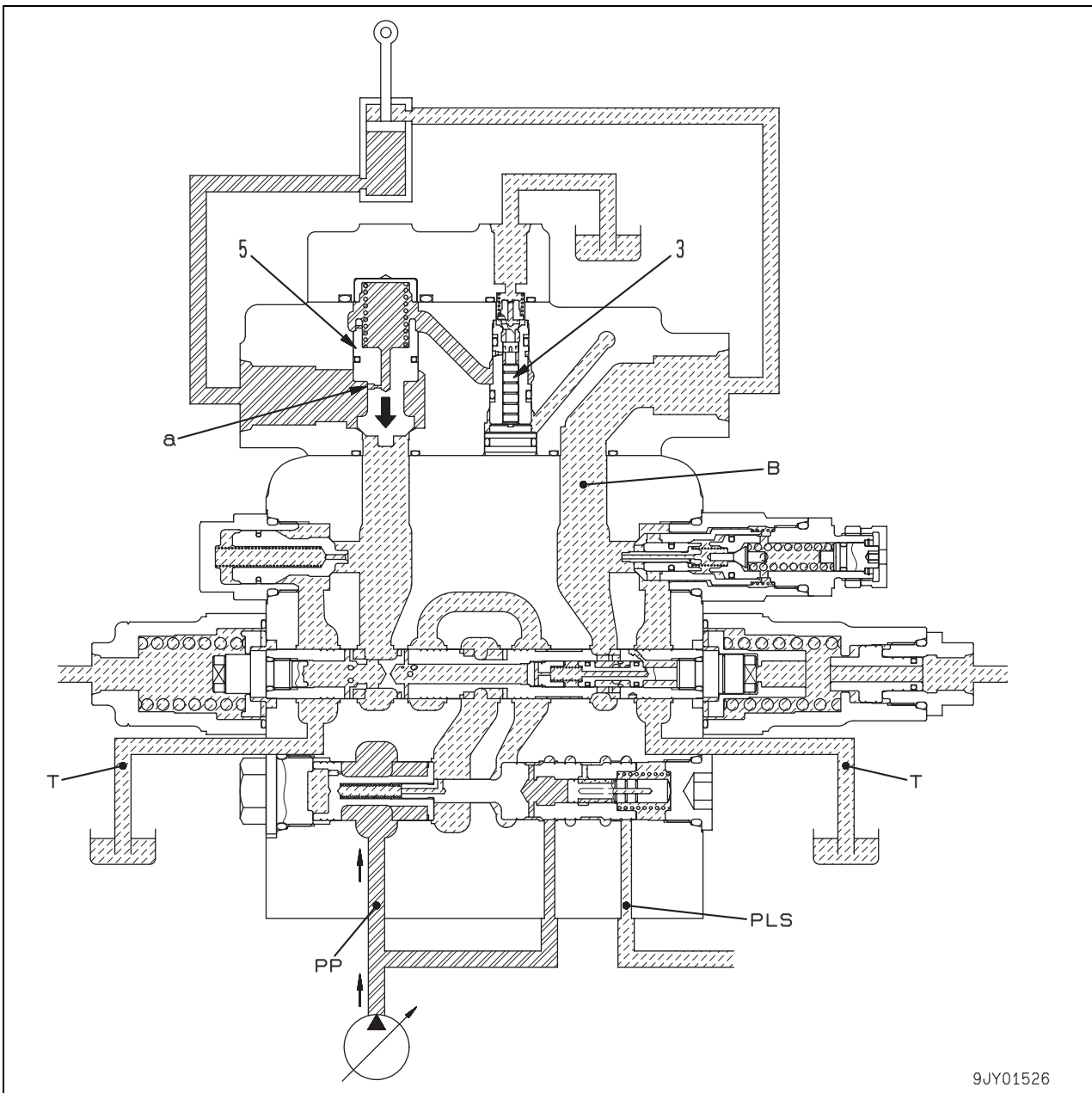
Function

- While the boom and arm levers are not operated, the hydraulic drift prevention valve prevents oil from leaking from the boom bottom and arm head through spool (1) to prevent the boom and arm from drifting hydraulically.

Operation

- If the boom is raised and the arm is moved out, the main pressure from the control valve pushes up poppet (5). As a result, the main pressure from the control valve flows through the valve into the boom cylinder bottom.

2. When boom and arm are set in neutral

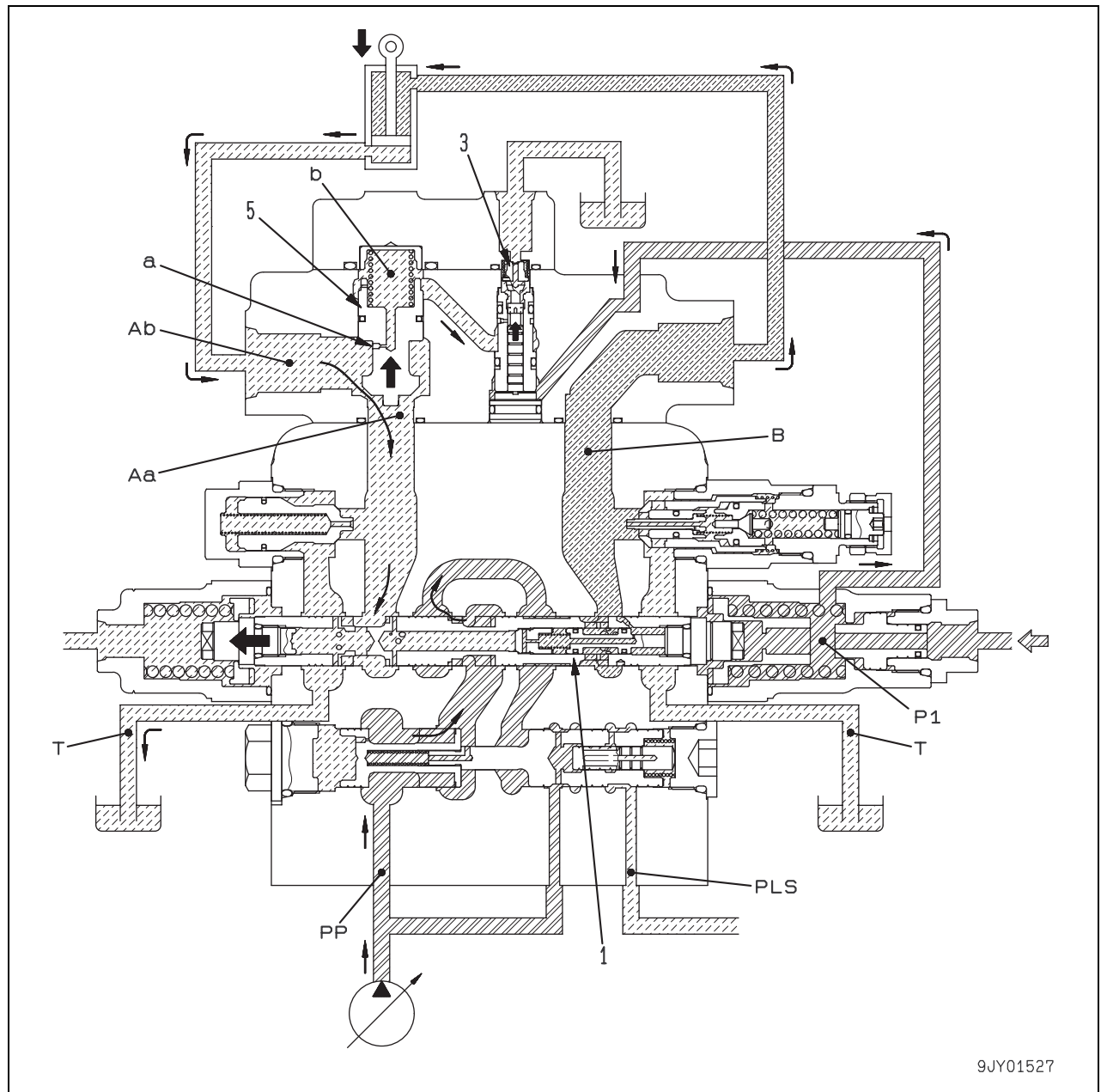


9JY01526

Operation

- If the control lever is returned to the neutral position while the boom is raised and the arm is moved out, the holding pressure in the boom cylinder bottom and arm cylinder head is blocked by poppet (5) and the pressurized oil flowing in through orifice (a) is blocked by pilot spool (3). Accordingly, the boom and arm are held.

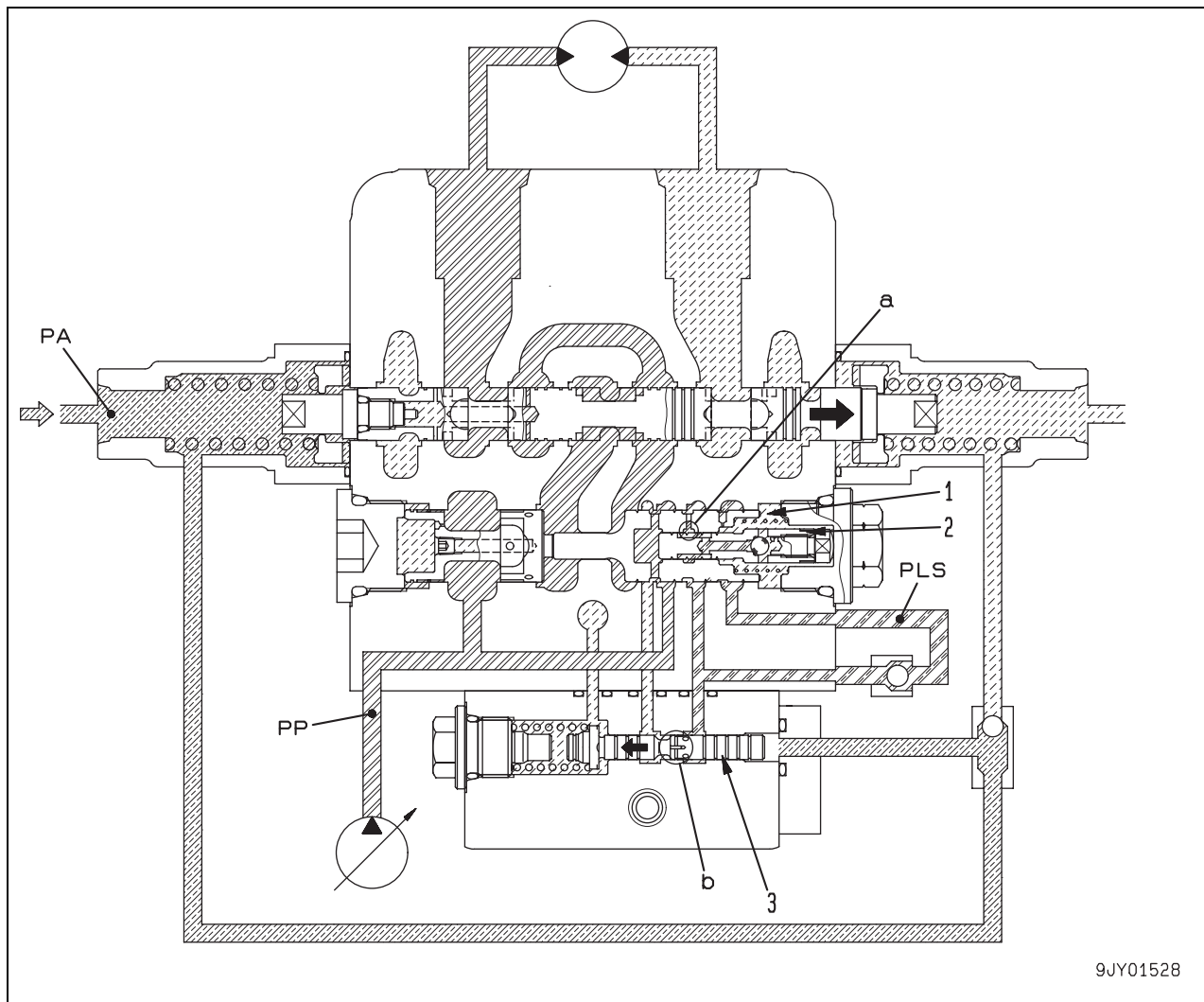
3. When boom is lowered and arm is moved in



Operation

- If the boom is lowered and the arm is moved in pilot pressure (P1) from the (PPC) valve pushes pilot spool (3) and the pressurized oil in chamber (b) in the poppet is drained.
- The oil pressure in port (Ab) is raised by the pressurized oil from the boom cylinder bottom and arm cylinder head, but the oil pressure in chamber (b) is lowered by orifice (a).
- If the pressure in chamber (b) is lowered below the pressure in port (Aa), poppet (5) opens and the pressurized oil from port (Ab) flows through port (Aa) into the control valve.

Swing bleeding valve



Function

- When the machine swings, the bleeding valve installed to the pressure reducing valve works so that the LS pressure rises gradually and the machine swings smoothly.
- Accordingly, the intermediate pressure is set lower than pump discharge pressure (PP) and raised as bleeding spool (3) moves. As a result, LS pressure (PLS) rises gradually.
- When the lever is in neutral or operated fully, the bleed-off circuit is closed.

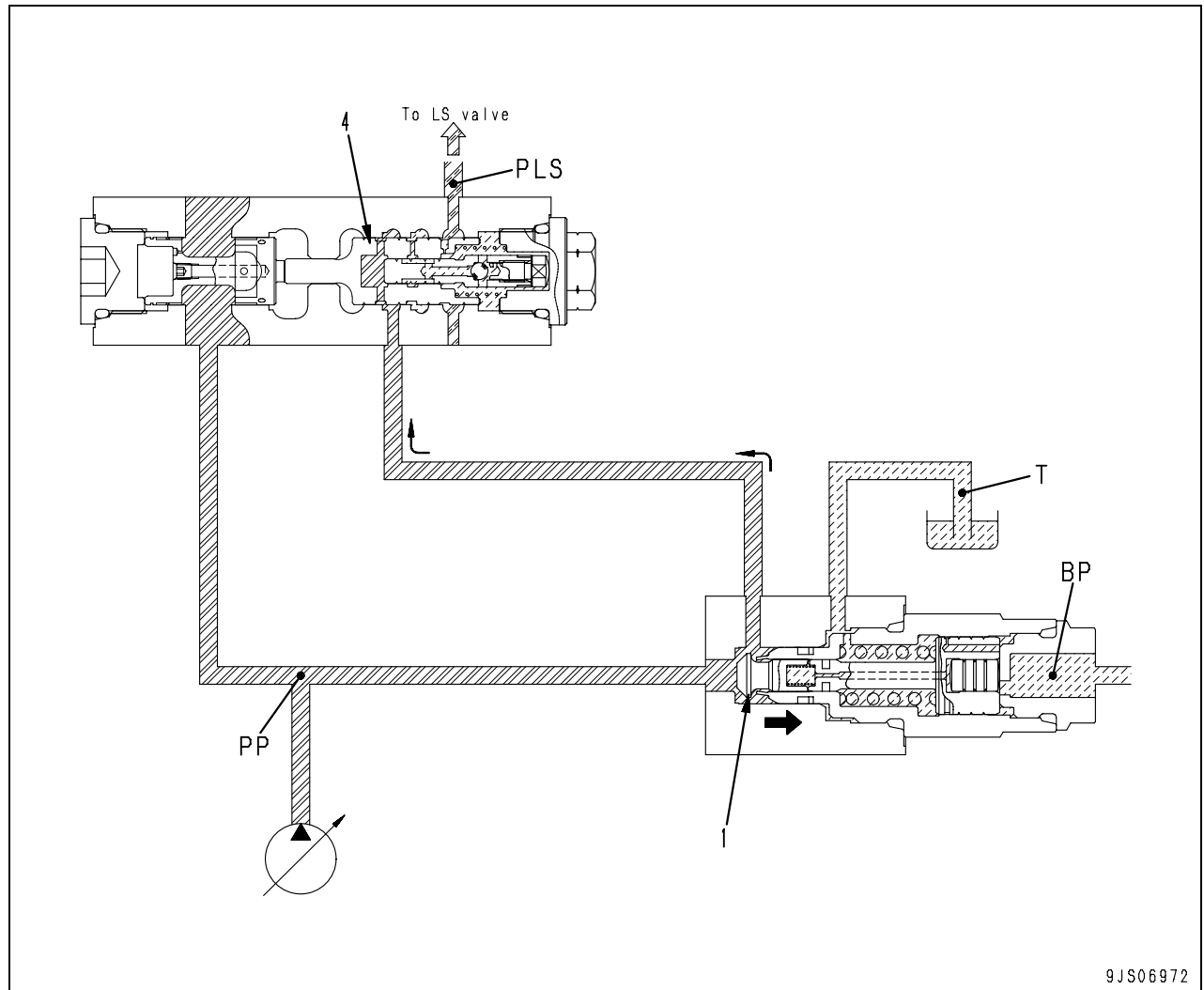
Operation

(In fine control operation)

- The pressure reducing valve moves to the right and notch (a) connects to the LS circuit. As a result, pump circuit (PP), bleed-off circuit, and LS circuit are connected through piston (2).
- Bleeding spool (3) moves to the left in proportion as swing (PPC) pressure (PA) rises. In the fine control area, notch (b) chokes the bleed-off circuit and determines the intermediate pressure before the lowered pressure is applied to pump discharge pressure (PP) and LS pressure (PLS).

LS select valve

1. During normal operation



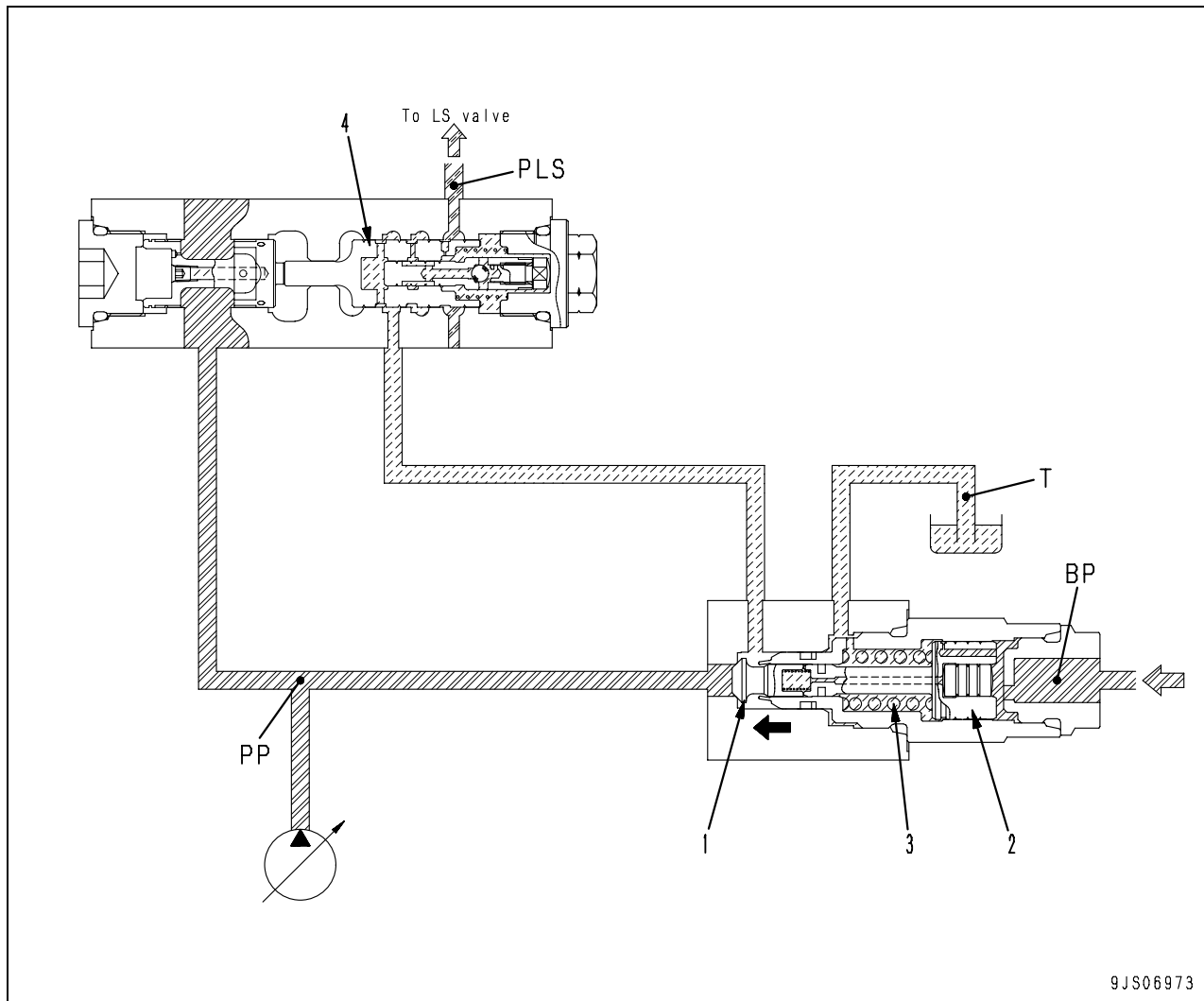
Function

- At the time of simultaneous operation of swing + boom RAISE, this valve prevents high swing LS pressure from entering the LS circuit (PLS) and also prevents the boom RAISE speed from reducing by securing the pump flow at the time of swing drive.

Operation

- The pilot pressure is not generally applied to the pilot port (BP) except for boom RAISE operation.
- In this state, the pump discharge pressure (PP) pushes the valve (1) to open it and is led to the pressure reducing valve (4) of the swing valve. At the time of swing operation, there occurs the LS pressure (PLS) suitable for the load pressure, and the pressure is led to the pump LS valve.

2. At simultaneous operation of swing + boom RAISE

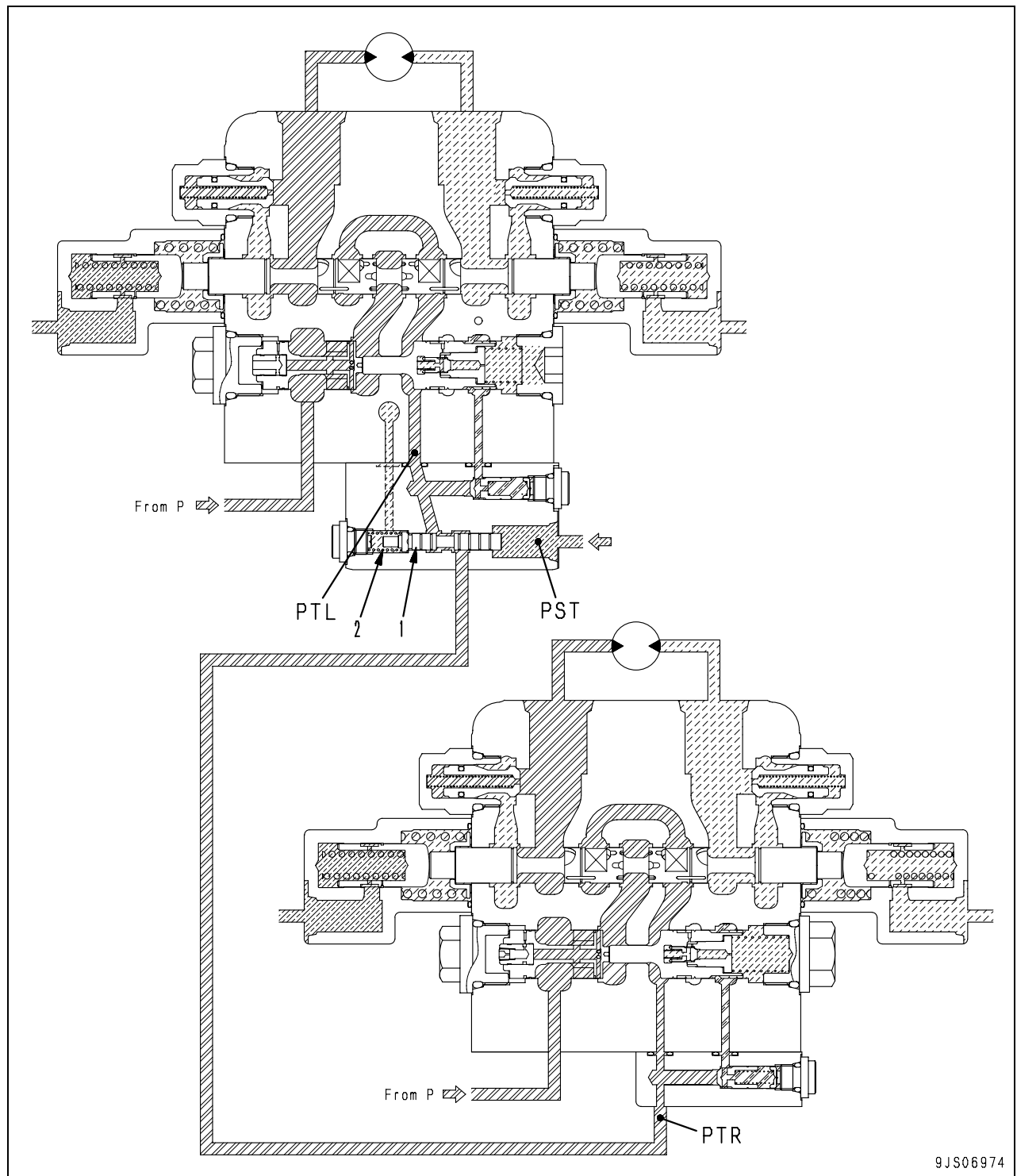


9JS06973

Operation

- At the simultaneous operation of swing + boom RAISE, the signal pressure of the PPC circuit is led to the pilot port (BP).
- When this pilot pressure (BP) is applied to the piston (2) and reaches a pressure that is stronger than the spring (3), the piston (2) will be pushed to the left side, the valve (1) will close and the pump discharge pressure (PP) will not come to flow to the pressure reducing valve (4) of the swing valve.
- Then, the swing pressure does not cause LS pressure (PLS), but the LS pressure (PLS) cause the boom RAISE pressure is led to the pump LS valve, and the pump delivery is controlled with the boom RAISE LS pressure.
- The pilot pressure (BP) depends on the control lever stroke.

Travel junction valve



Function

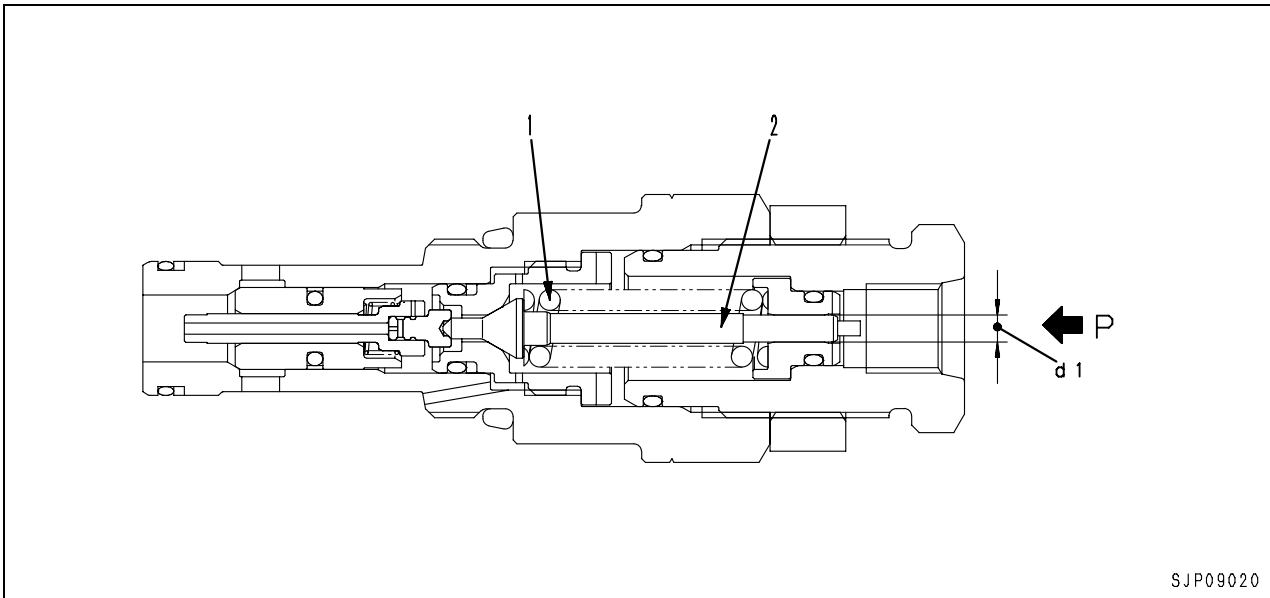
- This valve connects both travel circuits to each other so that hydraulic oil will be supplied evenly to both travel motors and the machine will travel straight.
- When the machine is steered, outside pilot pressure (PST) doses the travel junction valve to secure high steering performance.

Operation

When pilot pressure is turned ON

If the pilot pressure from the travel junction solenoid valve becomes higher than the force of spring (2), travel junction spool (1) moves to the left stroke end and the junction circuit between pore (PTL) (Left travel circuit) and (PTR) (Right travel circuit) is closed.

Main relief valve



1. Spring
2. Poppet

Function

- Set pressure of the relief valve is in two stages.
- When power is needed, pilot pressure (P) is turned ON and the set pressure becomes higher.

Operation

- The set pressure of relief valve is determined by spring (1) installed load. (1st stage)
- Respective setting is not required for both the 1st and 2nd stages. Setting the 1st stage completes the setting of the 2nd stage.

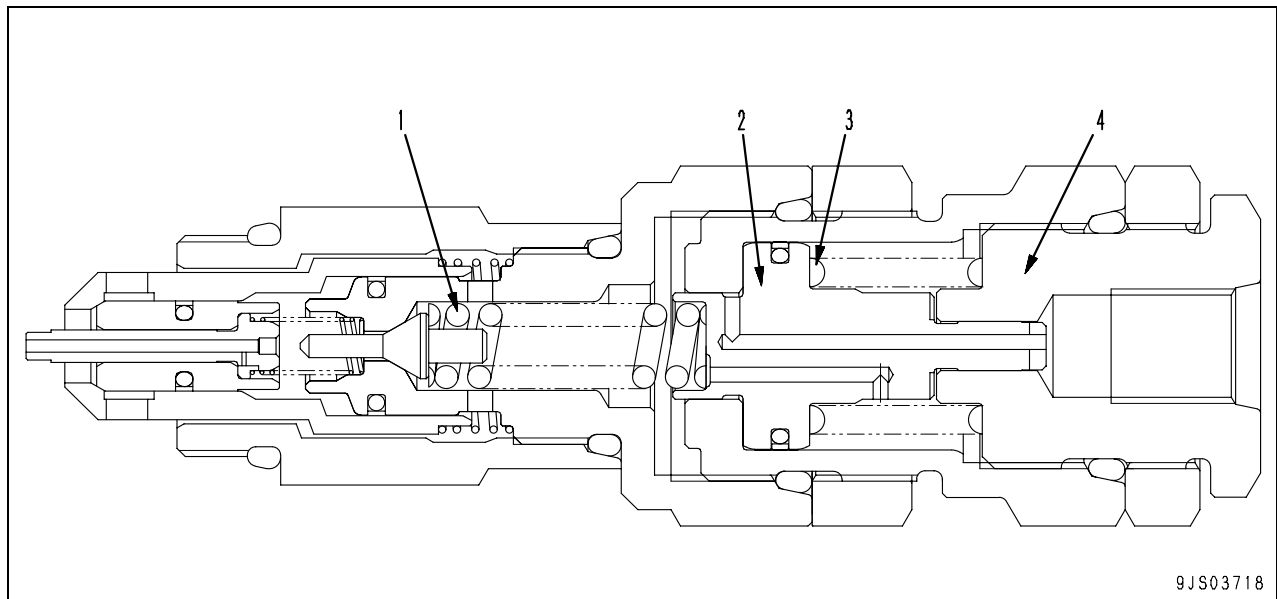
1. If pilot pressure (P) is OFF: Low-pressure setting

Set pressure is determined by spring (1) installed load.

2. If pilot pressure (P) is ON: High-pressure setting

Spring (1) installed load is added with pilot pressure (P) applied to the area of poppet diameter (d1), raising the set pressure to higher level.

2-stage suction safety valve [Installed to port (B) of the service valve]



1. Spring
2. Piston
3. Spring
4. Holder

Function

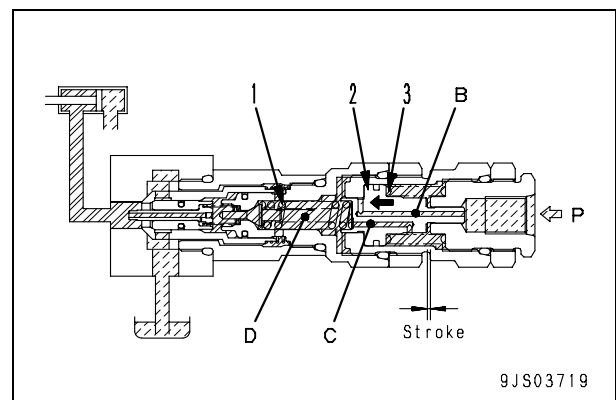
- Enables to provide the safety valve set pressure in two stages, and make the low-pressure setting smaller.
- Enables to relieve a load without lever operation if high load is applied to the cylinder.
- Improves work efficiency and reduces machine body vibration.

Operation

- The safety valve set pressure is determined by spring (1) installed load.

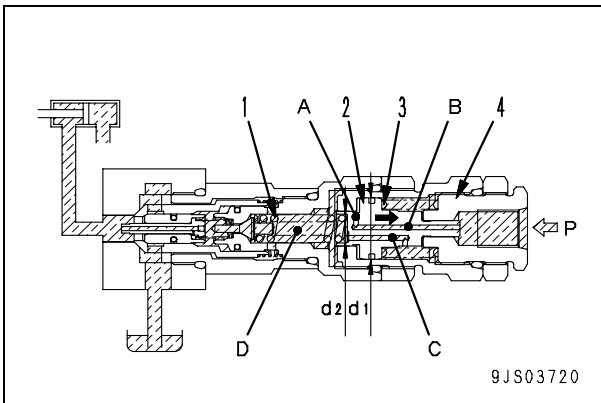
1. If pilot pressure is OFF (high-pressure setting)

- Since pilot pressure (P) is OFF, piston (2) is pressed to the left by spring (3). [Spring (1) installed load < spring (3) installed load]
- Spring (1) installed load becomes maximum and the set pressure rises.
- Passage (B) is interconnected to the drain circuit via passage (C) and chamber (D).

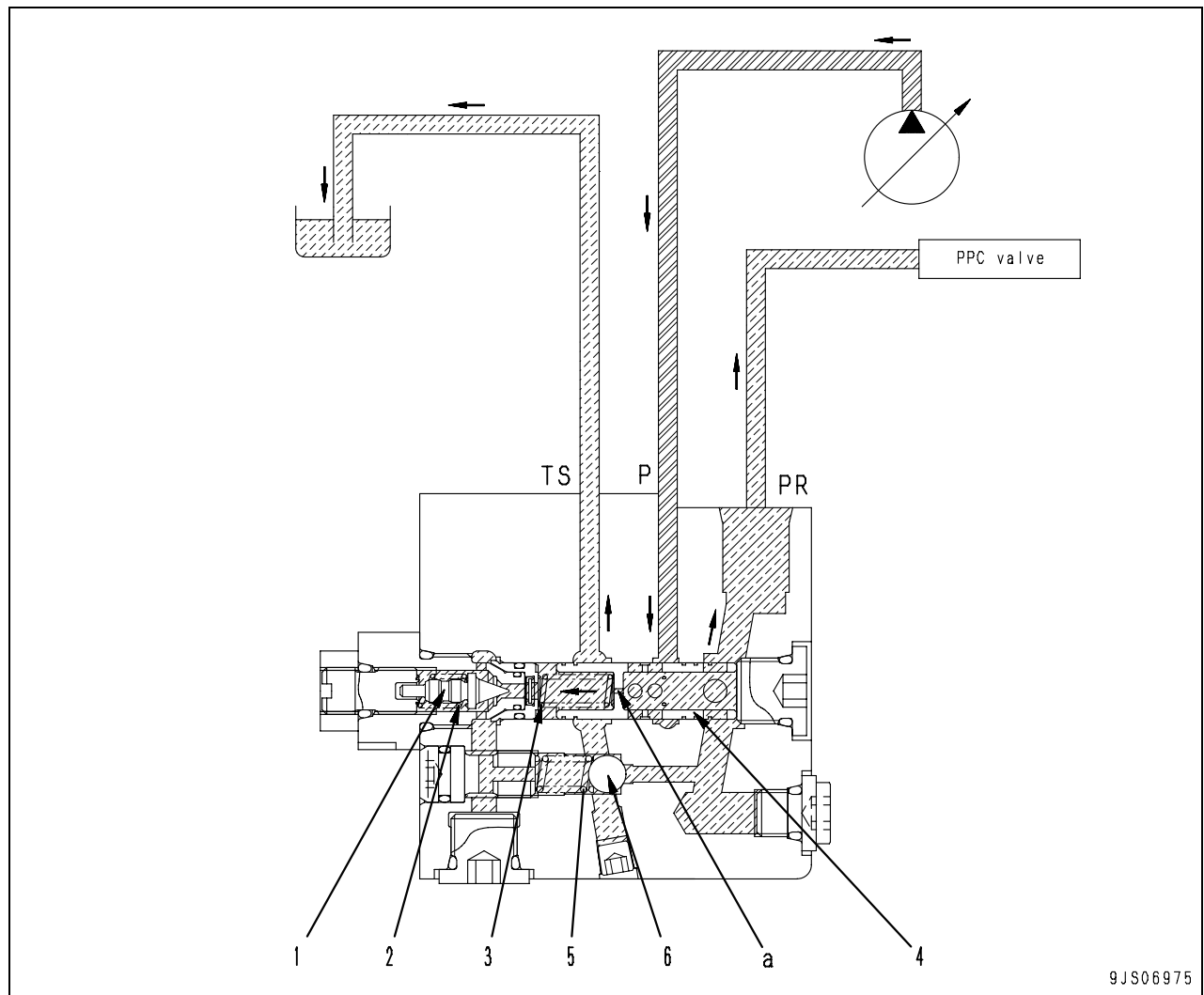


2. If pilot pressure is ON (low-pressure setting)

- If the pilot pressure (P) is ON, the pilot pressure is led to section (A) via passage (B).
- Piston (2) works on the pressure-receiving bore portion [(d2) – (d1)] of section (A).
- This pilot pressure contracts spring (3), and piston (2) moves to the right until making contact with holder (4).
- Spring (1) stretches, installed load is reduced, and the set pressure lowers.
- Pressurized oil proportionate to the piston stroke is drained via passage (C) and chamber (D).



Self-reducing pressure valve



Function

- The self-reducing pressure valve lowers the discharge pressure of the main pump and supplies it as the control pressure for the solenoid valves, PPC valves, etc.

Operation

- If the (PR) pressure rises higher than the set level, poppet (1) opens and the hydraulic oil flows from port (PR) through orifice (a) in spool (4) and opening of poppet (1) into seal drain port (TS).
- Accordingly, differential pressure is generated over orifice (a) in spool (4) and spool (4) moves in the direction to close the opening between ports (P) and (PR). The (P) pressure is lowered and controlled to a constant pressure (set pressure) by the opening ratio at this time and supplied as the (PR) pressure.

When abnormally high pressure is generated

- If the (PR) pressure of the self-reducing pressure valve is raised abnormally, ball (6) separates from the seat against the force of spring (5). As a result, the hydraulic oil flows from output port (PR) to (TS) and the (PR) pressure lowers.
- Accordingly, the devices receiving the oil pressure (PPC valves, solenoid valves, etc.) are protected from abnormally high pressure.

PC160LC-7E0, PC180LC/NLC-7E0 Hydraulic excavator

Form No. UEN01903-00

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HYDRAULIC EXCAVATOR

PC160LC-7E0
PC180LC-7E0
PC180NLC-7E0

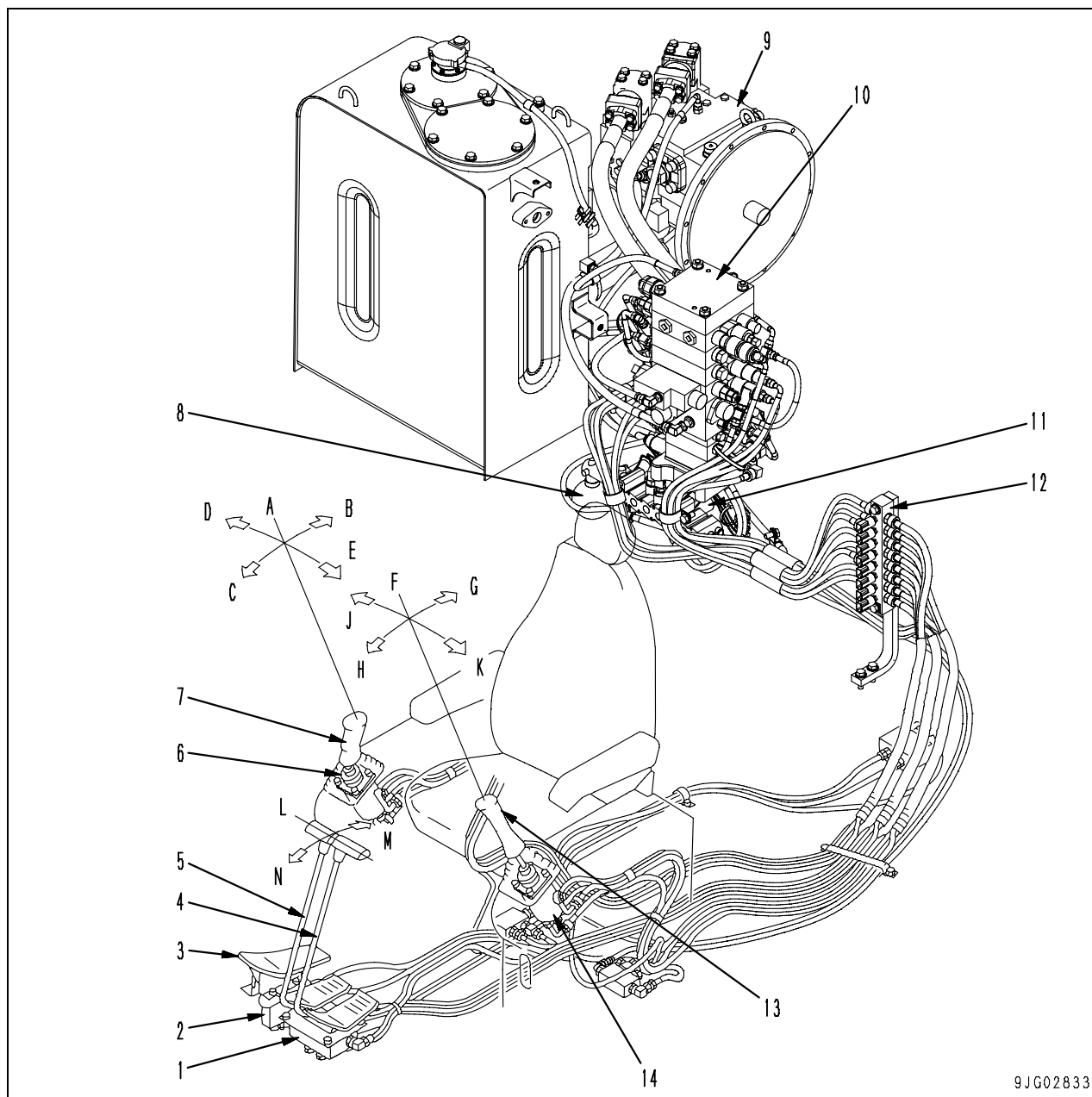
Machine model	Serial number
PC160LC-7E0	K45001 and up
PC180LC-7E0	K45001 and up
PC180NLC-7E0	K45001 and up

10 Structure, function and maintenance standard

Hydraulic system, Part 3

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Accumulator	22
Return oil filter	23
Centre swivel joint.....	24
Travel motor	25
Swing motor	35
Attachment circuit selector valve	36
Quick coupler control valve.....	40
Hydraulic cylinder.....	42

Valve control



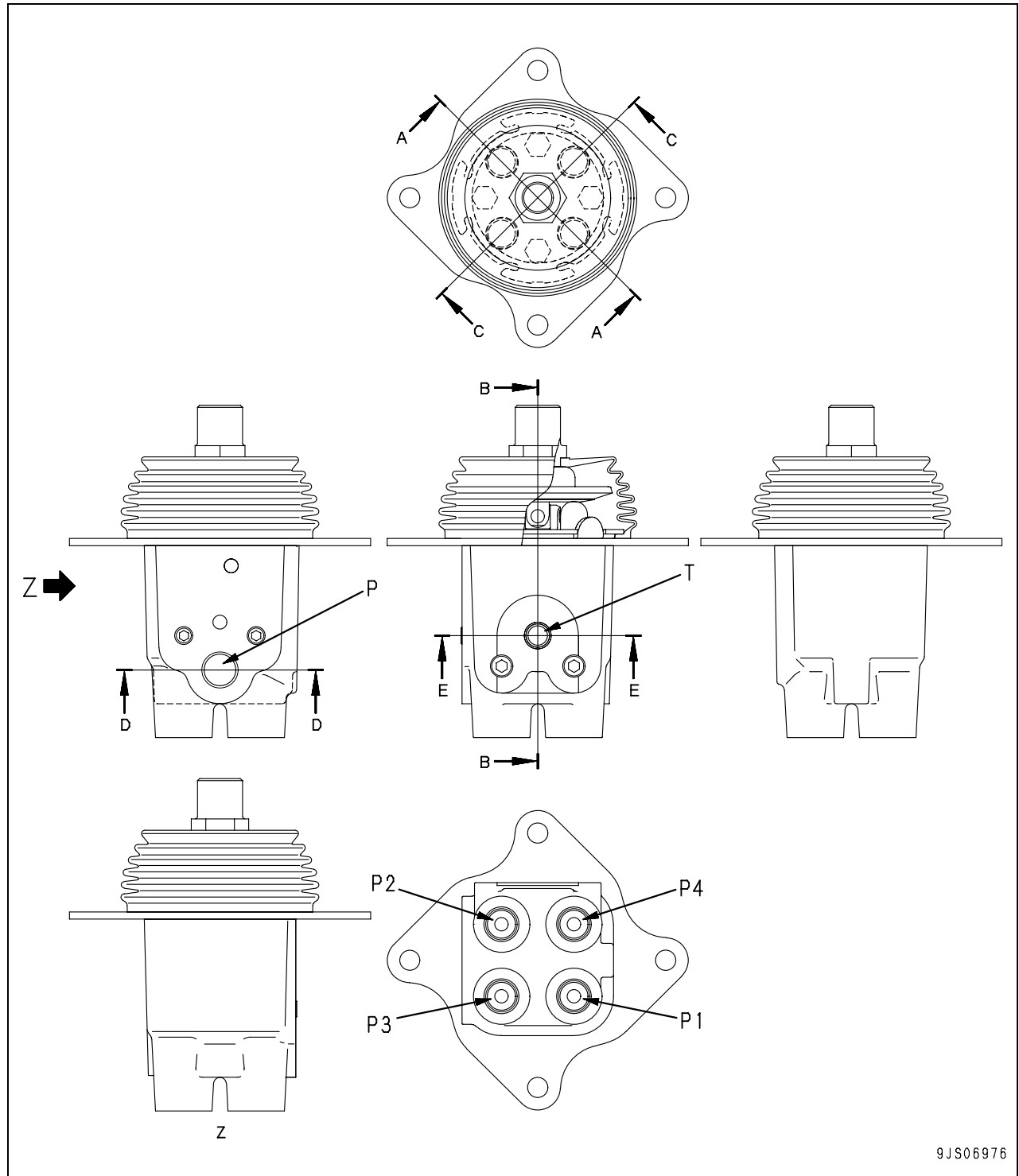
9JG02833

1. Travel PPC valve
2. Service PPC valve
3. Service pedal
4. L.H. travel lever
5. R.H. travel lever
6. R.H. PPC valve
7. R.H. work equipment control lever
8. Accumulator
9. Hydraulic pump
10. Control valve
11. Solenoid block
12. Junction box
13. L.H. work equipment control lever
14. L.H. PPC valve

- A : Hold
 B : Boom "RAISE"
 C : Boom "LOWER"
 D : Bucket "DUMP"
 E : Bucket "CURL"
 F : Hold
 G : Arm "IN"
 H : Arm "OUT"
 J : Swing "RIGHT"
 K : Swing "LEFT"
 L : Neutral
 M : Travel "REVERSE"
 N : Travel "FORWARD"

PPC valve

Work equipment and swing PPC valve



9JS06976

P : From self pressure reducing valve

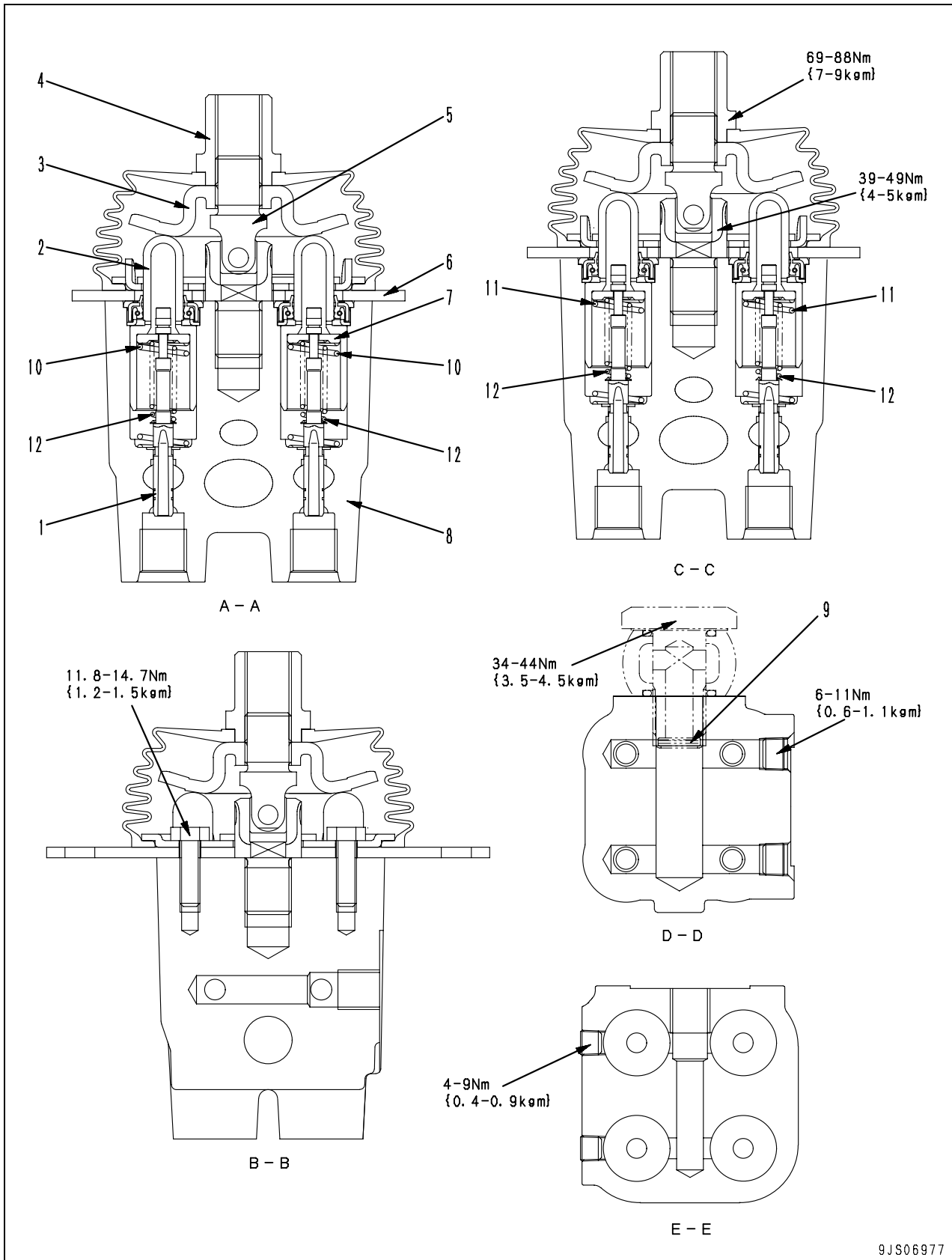
P1 : L.H. PPC valve: Arm OUT port/R.H. PPC valve: Boom LOWER port

P2 : L.H. PPC valve: Arm IN port/R.H. PPC valve: Boom RAISE port

P3 : L.H. PPC valve: Swing LEFT port/R.H. PPC valve: Bucket CURL port

P4 : L.H. PPC valve: Swing RIGHT port/R.H. PPC valve: Bucket DUMP port

T : To tank



1. Spool
2. Piston
3. Disc
4. Nut (for lever connection)
5. Joint
6. Plate
7. Retainer
8. Body
9. Filter

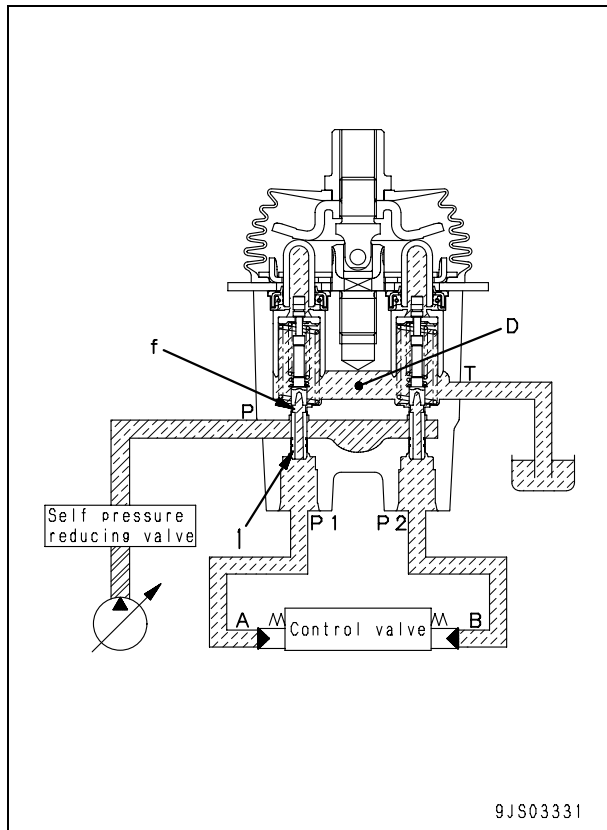
Unit: mm

No.	Check item	Criteria					Remedy
10	Centring spring (for ports P3 and P4)	Standard size			Repair limit		If damaged or deformed, replace spring.
		Free length x Outside diameter	Installation length	Installation load	Free length	Installation load	
		42.5 x 15.5	34.0	17.7 N {1.80 kg}	—	14.1 N {1.44 kg}	
11	Centring spring (for ports P1 and P2)	44.5 x 15.5	34.0	29.4 N {3.0 kg}	—	23.5 N {2.40 kg}	
12	Metering spring	26.5 x 8.15	24.9	16.7 N {1.70 kg}	—	13.3 N {1.36 kg}	

Operation

1. When in neutral

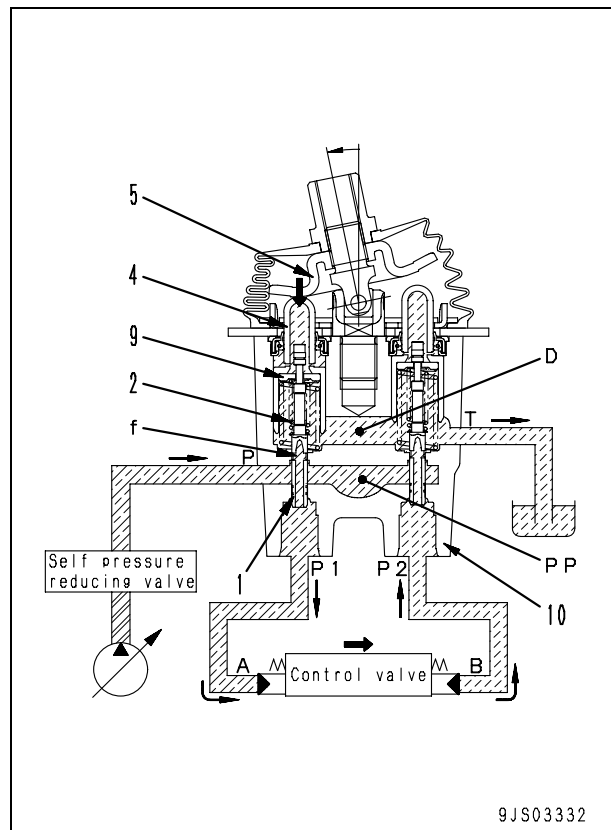
- Ports (A) and (B) of the control valve and ports (P1) and (P2) of the PPC valve are connected to drain chamber (D) through fine control hole (f) in spool (1).



2. During fine control (Neutral or fine control)

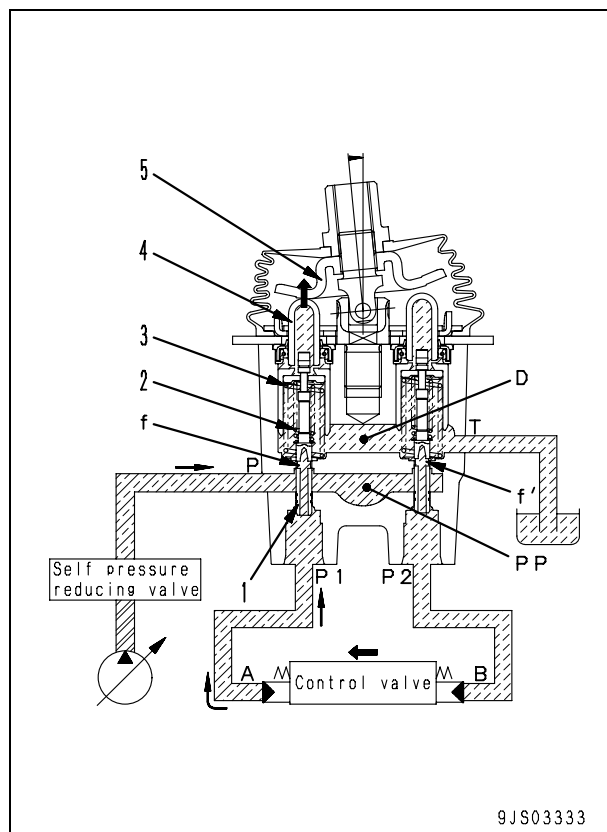
- When piston (4) is pushed by disc (5), retainer (9) is pushed, spool (1) is also pushed by metering spring (2), and moves down.
- When fine control hole (f) is shut off from drain chamber (D), it is almost simultaneously interconnected to pump pressure chamber (PP).
- Pilot pressurized oil of the control pump is led to port (A) from port (P1) through fine control hole (f).
- When the pressure at port (P1) becomes higher, spool (1) is pushed back and fine control hole (f) is shut off from pump pressure chamber (PP). At almost the same time, it is connected to drain chamber (D) to release the pressure at port (P1).
- As a result, spool (1) moves up and down until the force of metering spring (2) is balanced with the pressure at port (P1).

- The relationship of the position of spool (1) and body (10) [fine control hole (f) is in the middle between drain chamber (D) and pump pressure chamber (PP)] does not change until retainer (9) contacts spool (1).
- Metering spring (2) contracts in proportion to the stroke of the control lever.
- Pressure at port (P1) also rises in proportion to the stroke of the control lever.
- In this way, the control valve spool moves to a position where the pressure of chamber (A) (same as pressure at port (P1)) and the force of the return spring of the control valve spool are balanced.



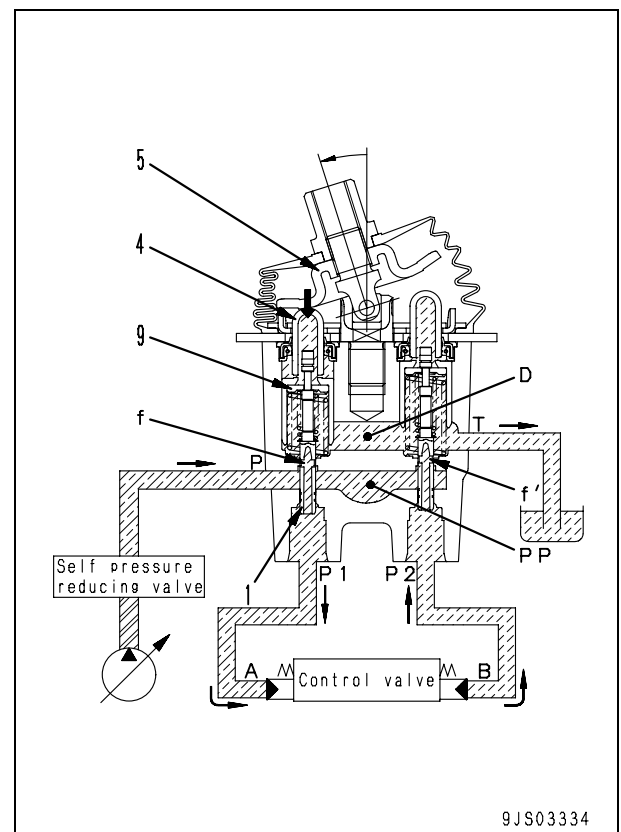
3. During fine control (When control lever is returned)

- When disc (5) starts to be returned, spool (1) is pushed up by the force of centring spring (3) and the pressure at port (P1).
- Because of this, fine control hole (f) is connected to drain chamber (D), and the pressurized oil at port (P1) is released.
- If the pressure of port (P1) is lowered excessively, spool (1) is pushed down by metering spring (2).
- Fine control hole (f) is shut off from drain chamber (D), and it is almost simultaneously interconnected to pump pressure chamber (PP).
- Pump pressure is supplied until the pressure at port (P1) recovers to the level equivalent to the lever position.
- When the spool of the control valve returns, the oil in drain chamber (D) flows in from fine control hole (f') in the valve on the side that is not working. The oil passes through port (P2) and enters chamber (B) to replenish the chamber with pressurized oil.

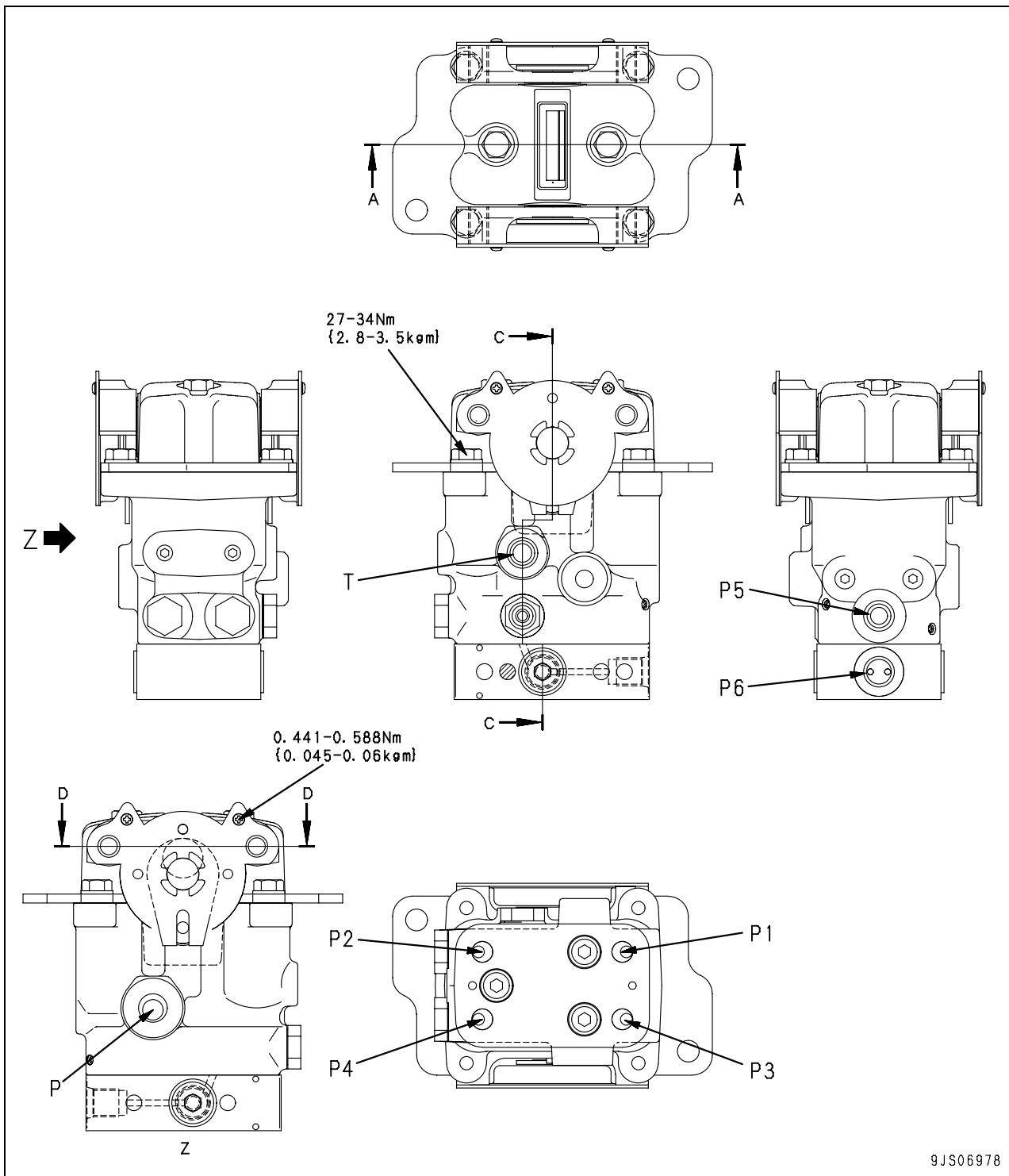


4. At full stroke

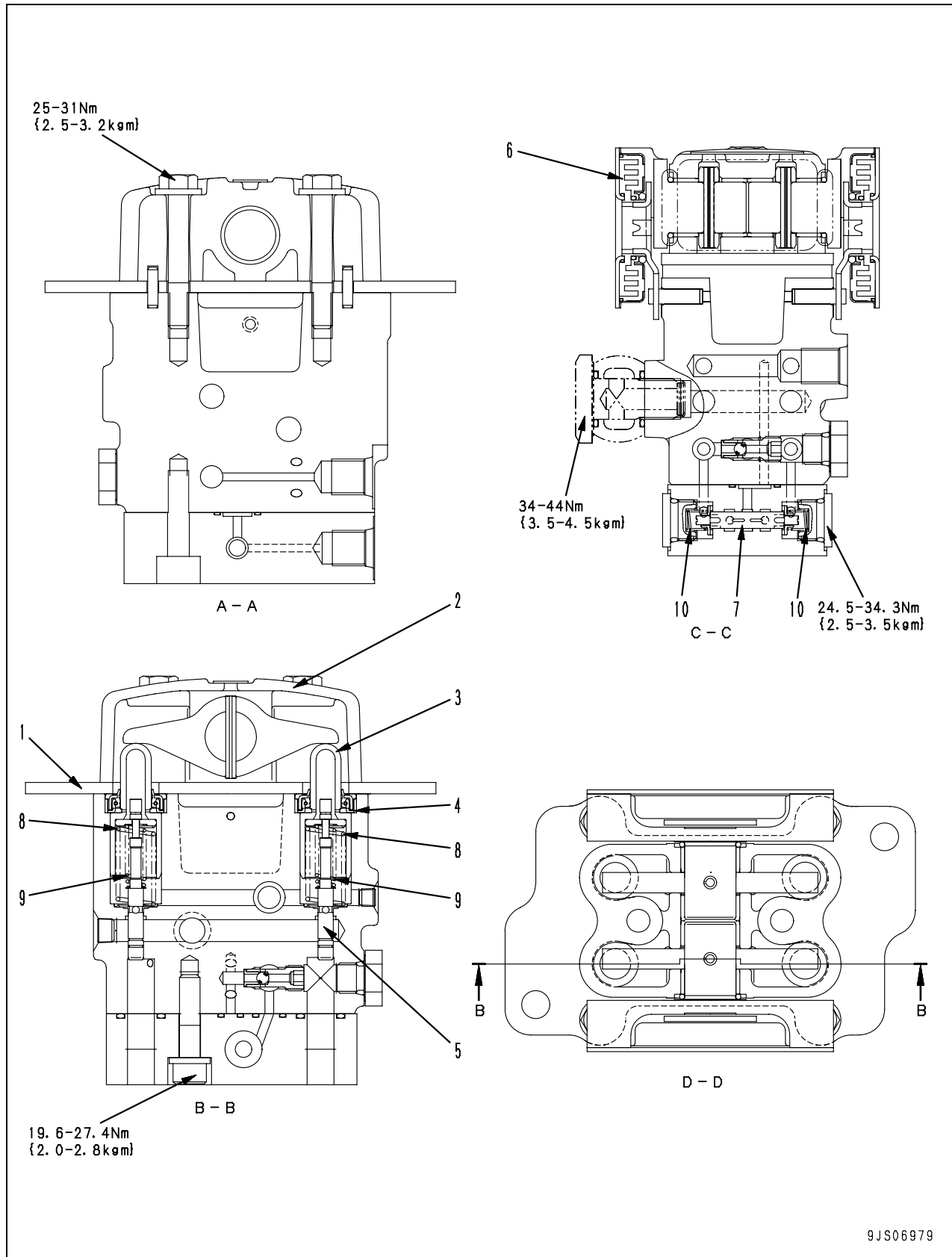
- Disc (5) pushes down piston (4), and retainer (9) pushes down spool (1).
- Fine control hole (f) is shut off from drain chamber (D), and is interconnected to pump pressure chamber (PP).
- Therefore, the pilot pressure oil from the self pressure reducing valve passes through fine control hole (f) and flows to chamber (A) from port (P1) to push the control valve spool.
- The oil returning from chamber (B) passes from port (P2) through fine control hole (f') and flows to drain chamber (D).



Travel PPC valve



- P : From self pressure reducing valve
P1 : L.H. travel REVERSE port
P2 : L.H. travel FORWARD port
P3 : R.H. travel REVERSE port
P4 : R.H. travel FORWARD port
P5 : Travel signal port
P6 : Steering signal port
T : To tank



1. Plate
2. Body
3. Piston
4. Collar
5. Valve
6. Damper
7. Steering signal spool

Unit: mm

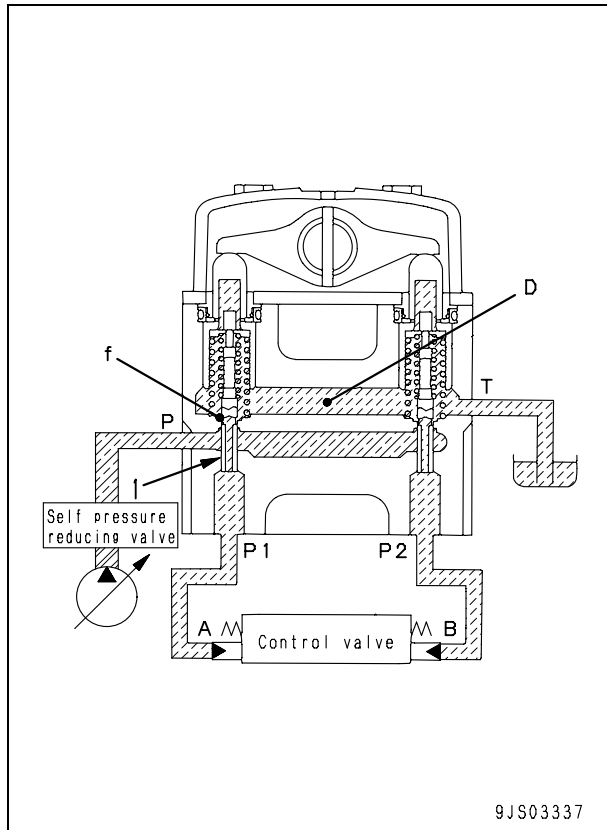
No.	Check item	Criteria					Remedy
8	Centring spring	Standard size			Repair limit		If damaged or deformed, replace spring.
		Free length x Outside diameter	Installation length	Installation load	Free length	Installation load	
		48.6 x 15.5	32.5	108 N {11.0 kg}	—	86.3 N {8.8 kg}	
9	Metering spring	26.5 x 8.15	24.9	16.7 N {1.7 kg}	—	13.3 N {1.36 kg}	
10	Steering signal spring	12.8 x 7.3	8.5	8.83 N {0.9 kg}	—	7.06 N {0.72 kg}	

1. Pressure reducing valve function

Operation

1) When in neutral

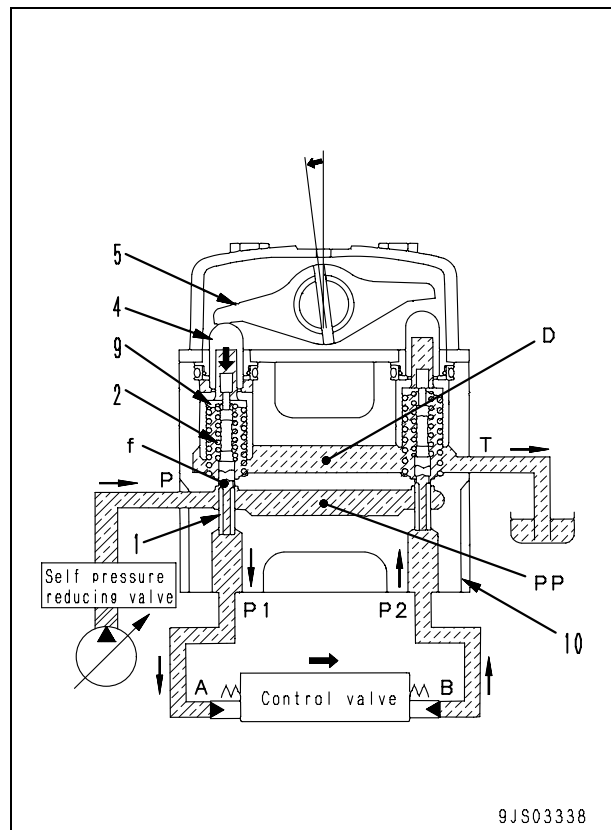
- Ports (A) and (B) of the control valve and ports (P1) and (P2) of the PPC valve are connected to drain chamber (D) through fine control hole (f) in spool (1).



2) During fine control (Neutral → fine control)

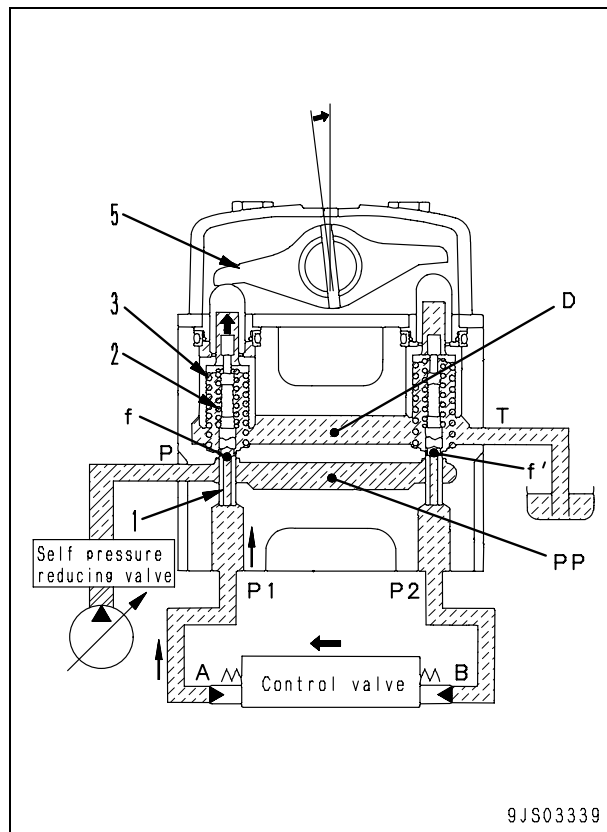
- When piston (4) is pushed by lever (5), retainer (9) is pushed, spool (1) is also pushed by metering spring (2), and moves down.
- When fine control hole (f) is shut off from drain chamber (D), it is almost simultaneously interconnected to pump pressure chamber (PP).
- Pilot pressurized oil of the control pump is led to port (A) from port (P1) through fine control hole (f).
- When the pressure at port (P1) becomes higher, spool (1) is pushed back and fine control hole (f) is shut off from pump pressure chamber (PP). At almost the same time, it is connected to drain chamber (D) to release the pressure at port (P1).
- As a result, spool (1) moves up and down until the force of metering spool (2) is balanced with the pressure at port (P1).

- The relationship of the position of spool (1) and body (10) [fine control hole (f) is in the middle between drain chamber (D) and pump pressure chamber (PP)] does not change until retainer (9) contacts spool (1).
- Metering spring (2) contracts in proportion to the stroke of the control lever.
- Pressure at port (P1) also rises in proportion to the stroke of the control lever.
- In this way, the control valve spool moves to a position where the pressure of chamber (A) (same as pressure at port (P1)) and the force of the return spring of the control valve spool are balanced.



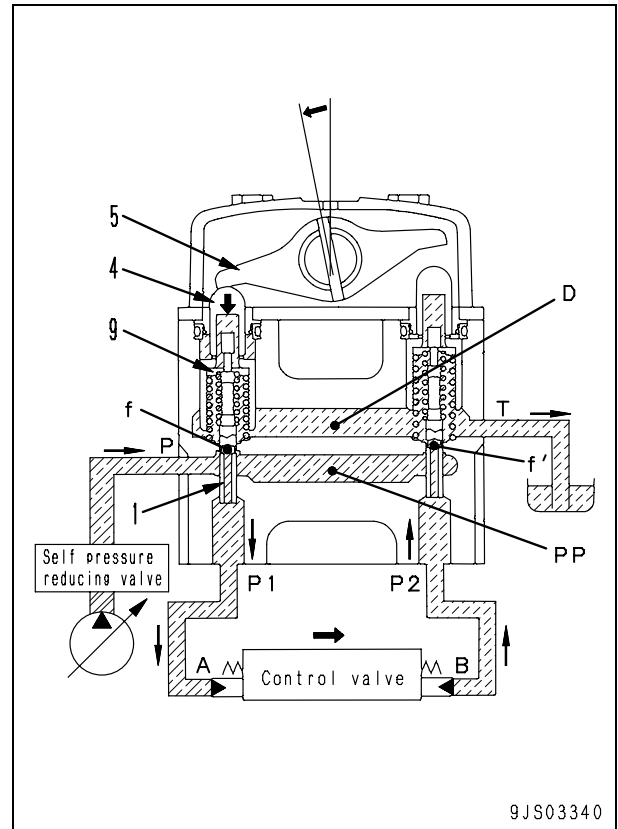
3) During fine control**(When control lever is returned)**

- When lever (5) starts to be returned, spool (1) is pushed up by the force of centring spring (3) and pressure at port (P1).
- Because of this, fine control hole (f) is connected to drain chamber (D), and the pressurized oil at port (P1) is released.
- If the pressure of port (P1) is lowered excessively, spool (1) is pushed down by metering spring (2).
- Fine control hole (f) is shut off from drain chamber (D), and it is almost simultaneously interconnected to pump pressure chamber (PP).
- Pump pressure is supplied until the pressure at port (P1) recovers to the level equivalent to the lever position.
- When the spool of the control valve returns, the oil in drain chamber (D) flows in from fine control hole (f') in the valve on the side that is not working. The oil passes through port (P2) and enters chamber (B) to replenish the chamber with pressurized oil.

**4) At full stroke**

- Lever (5) pushes down piston (4), and retainer (9) pushes down spool (1).
- Fine control hole (f) is shut off from drain chamber (D), and is interconnected to pump pressure chamber (PP).

- Therefore, the pilot pressure oil from the self pressure reducing valve passes through fine control hole (f) and flows to chamber (A) from port (P1) to push the control valve spool.
- The oil returning from chamber (B) passes from port (P2) through fine control hole (f') and flows to drain chamber (D).

**2. Travel signal/Steering function****Travel signal**

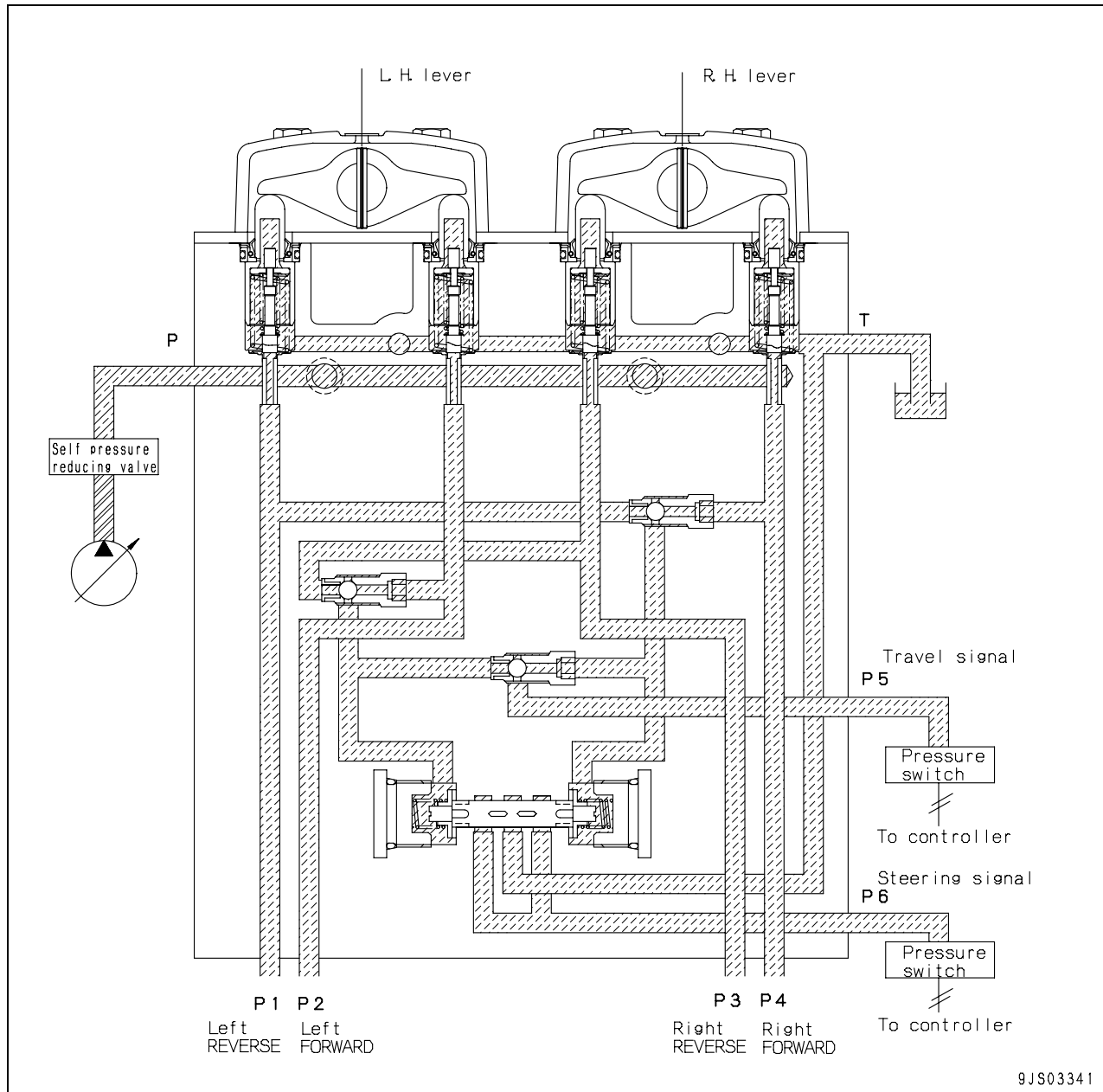
- If either of the L.H. or R.H. travel levers is operated, the higher PPC output pressure of both sides is output as the travel signal.
- Accordingly, whether the machine is travelling is judged by the signal of port (P5).

Steering signal

- If the operation quantities of both levers are different from each other as in the steering operation, the higher one of the PPC output pressures of both sides is output as the steering signal.
- Any signal is not output from port (P6) while the machine is travelling straight (forward or reverse) or in neutral.
- Accordingly, whether the machine is being steered is judged by the signal of port (P6).

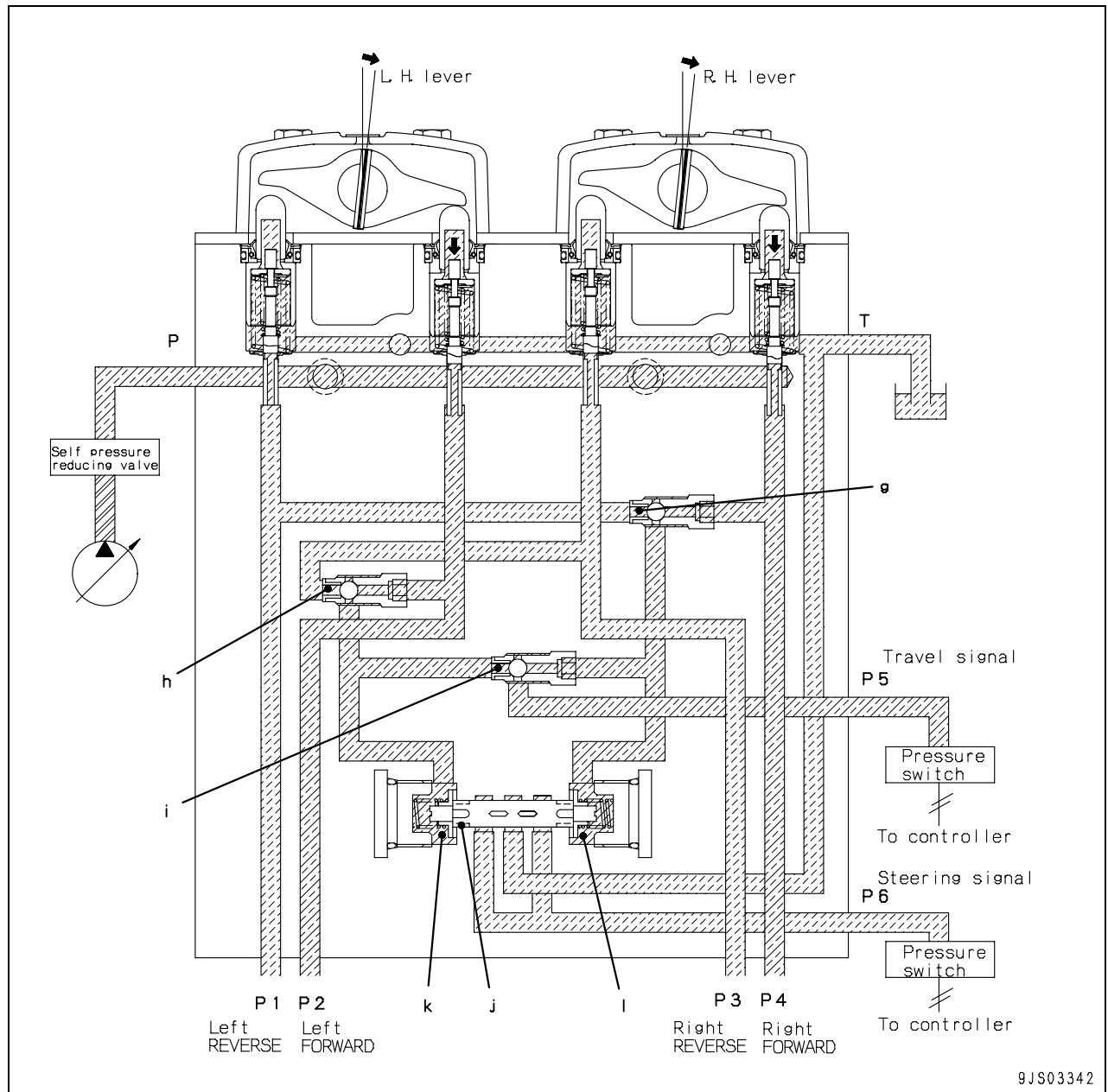
Operation

1) When in neutral



- No output is made from respective output ports [from port (P1) to (P4)], travel signal [port (P5)] and steering signal [port (P6)].

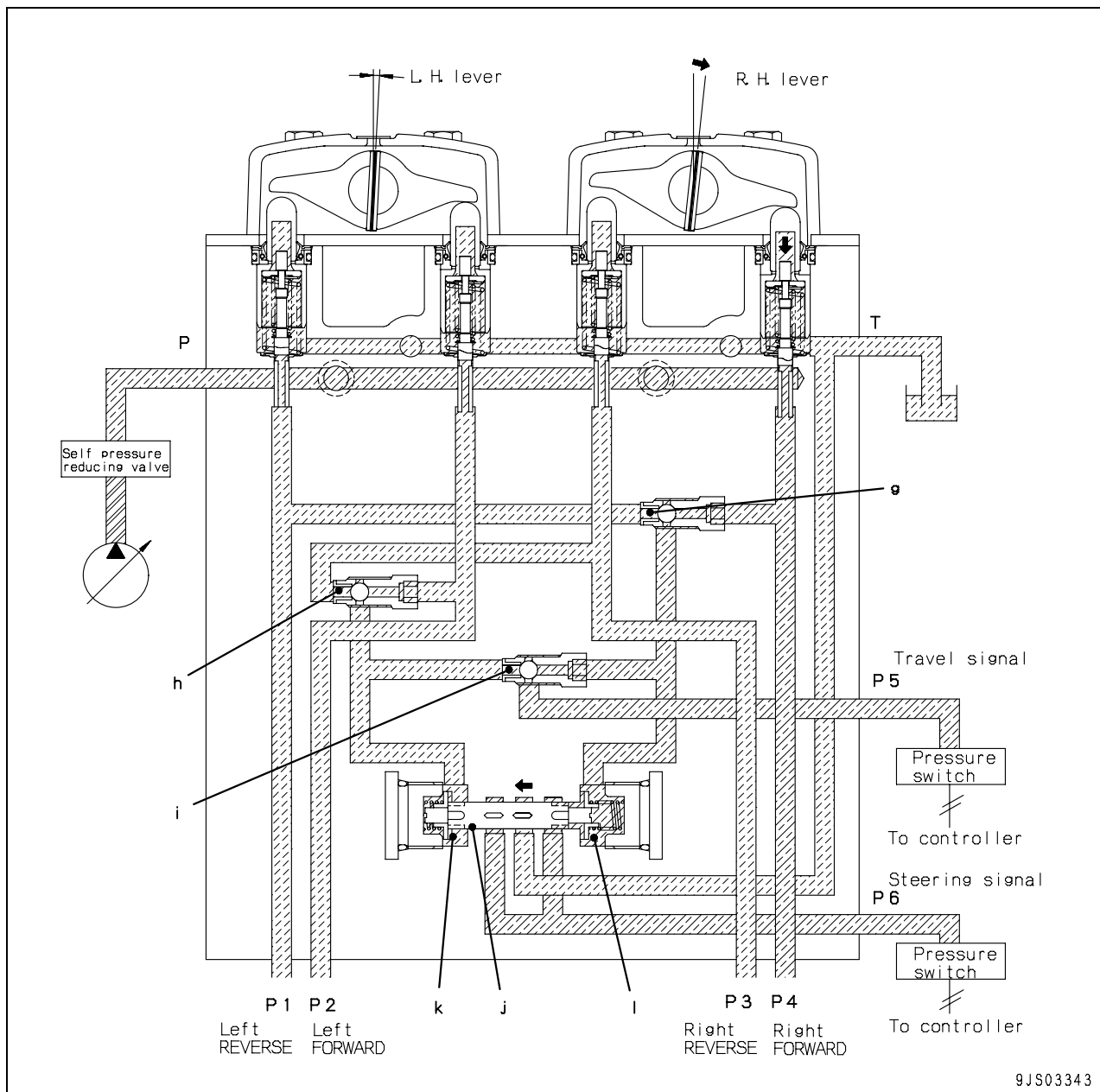
2) During straight travel



★ The Illustration shows the circuit for travelling straight forward.

- When operating L.H. motor forward [port (P2) output] and R.H. motor forward [port (P4) output], pressure of both L.H. spring chamber (k) and R.H. spring chamber (l) rises high.
- Steering signal spool (j) remains at neutral position and does not output a steering signal to port (P6).

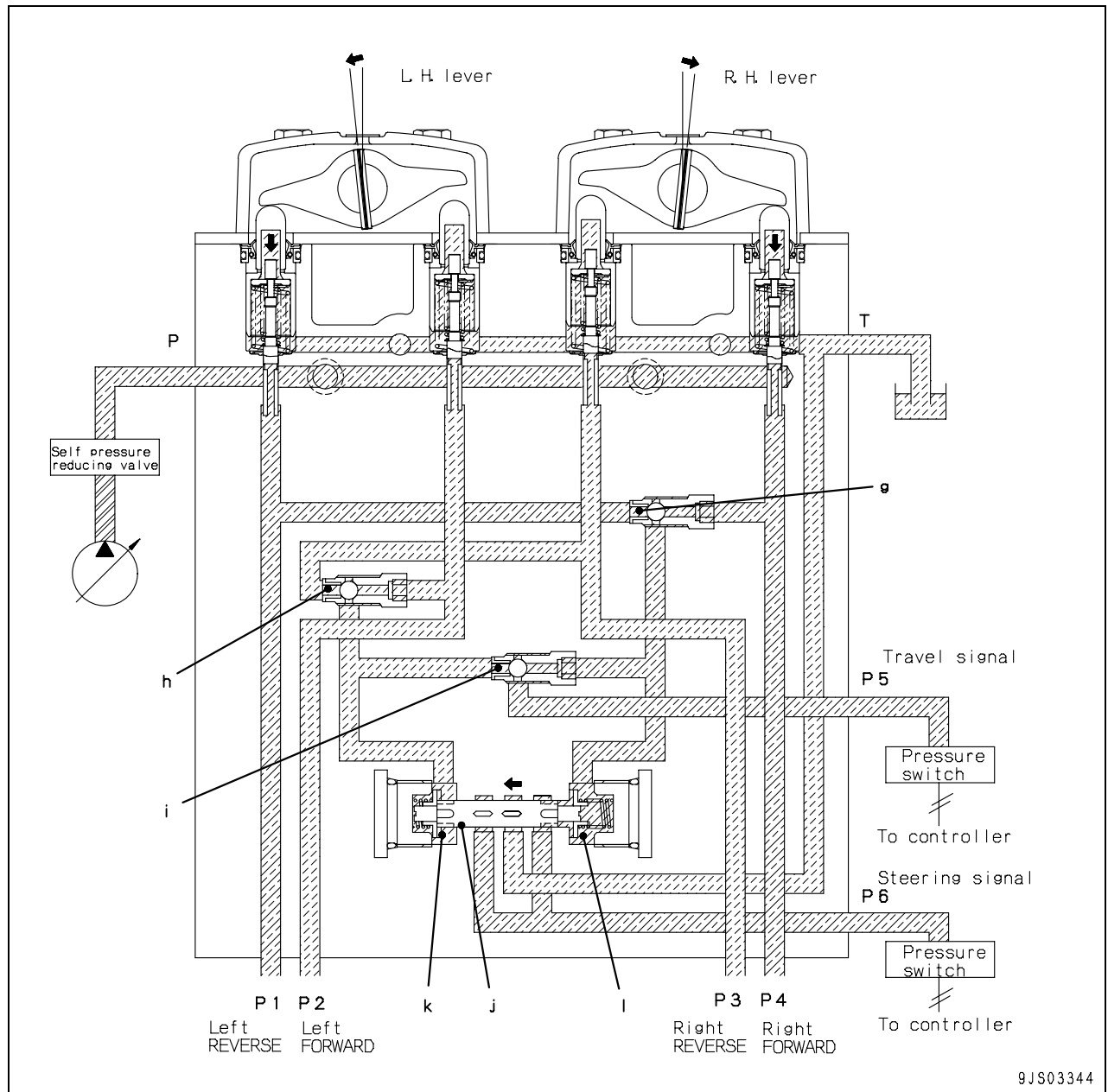
3) When steered or pivot-turned



★ The Illustration shows the circuit for travelling left forward (slow) and right forward (fast) operation.

- If the operation quantities of both levers are different from each other as in the steering operation (if the difference of the pilot pressure between both sides is higher than a certain level), the pilot pressure is output as the steering signal.
- The pressure in left spring chamber (k) of steering signal spool (j) is (P2).
- The pressure in right spring chamber (l) is (P4).
- When the pressure state reaches $[(P4 - P2) \times (\text{Spool section}) > \text{Spring set load}]$, the spool is switched to the direction of the arrow.
- Port (P4) pressure of the L.H. or R.H. PPC valves, whichever having a higher output pressure, is output to port (P6) as the steering signal.

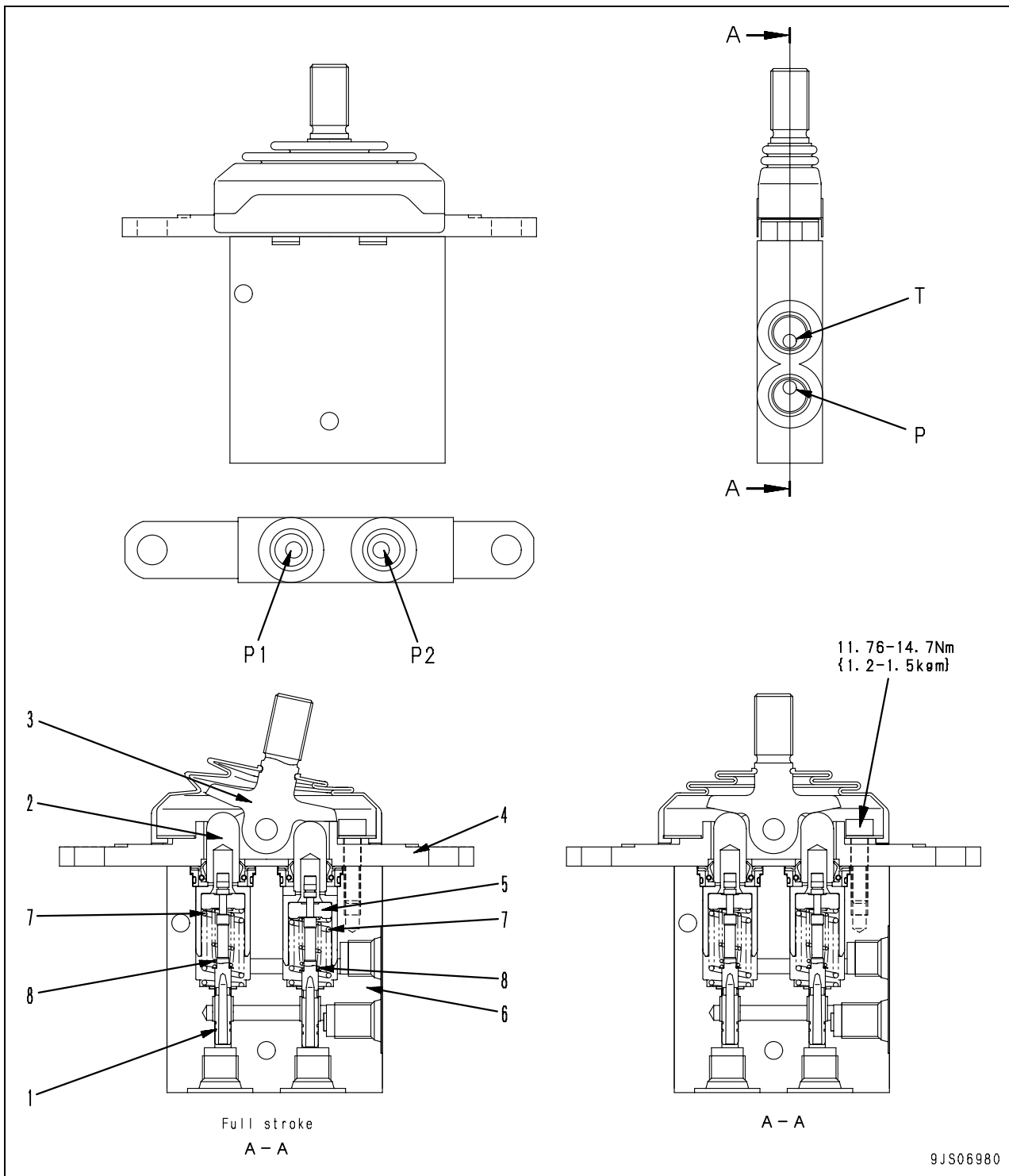
4) When counter-rotated



★ The illustration shows the circuit for travelling left reverse and right forward.

- When operating L.H. motor reverse [port (P1) output] and R.H. motor forward [port (P4) output], pressure of the R.H. spring chamber (l) only rises high.
- Steering signal spool (j) strokes to the left to output the steering signal to port (P6).

Service PPC valve



★ For the details of operation, see the paragraph of "Work equipment and swing PPC valve".

P : From self pressure reducing valve
 P1 : To service valve
 P2 : To service valve
 T : To tank

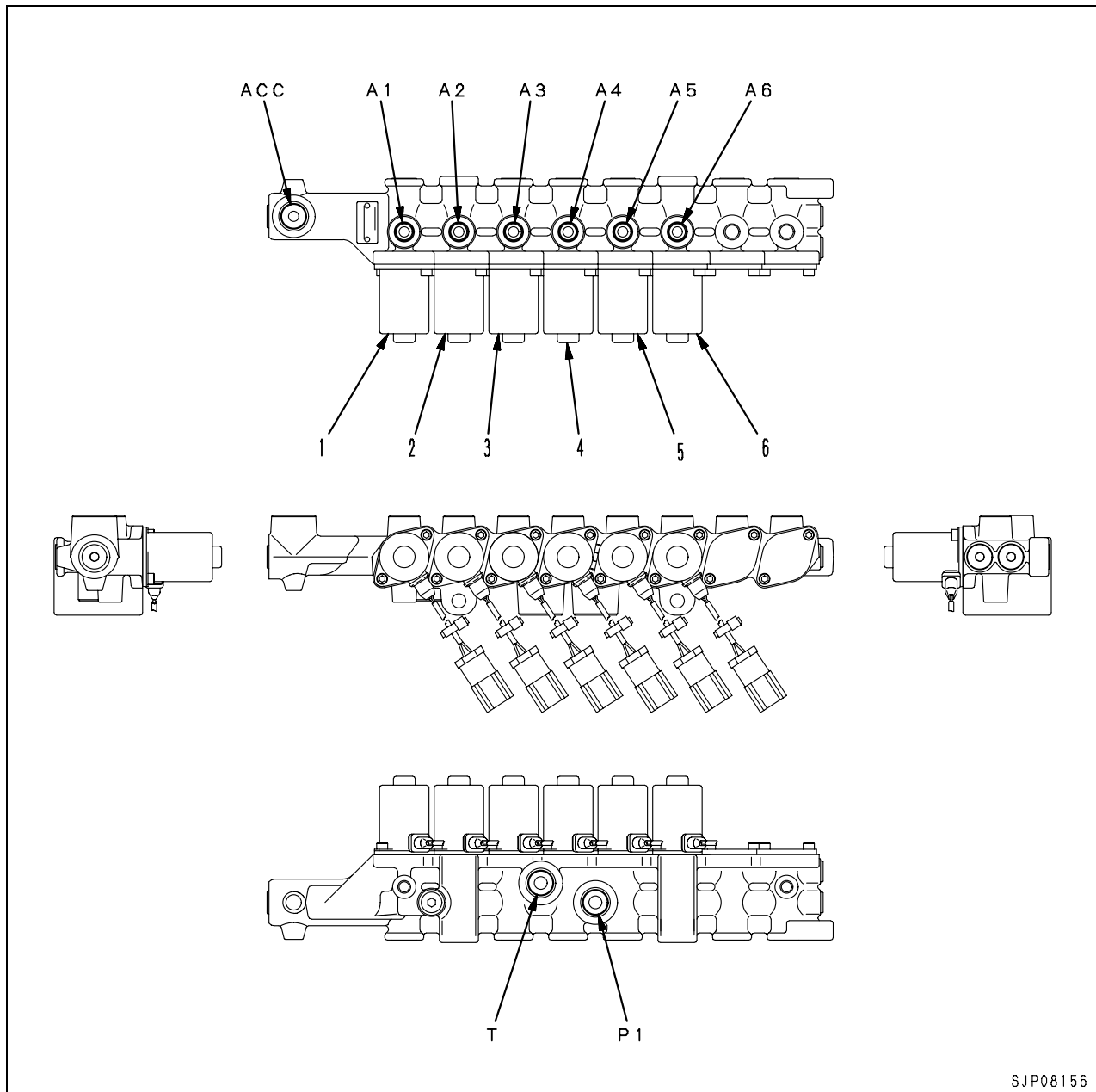
1. Spool
2. Piston
3. Lever
4. Plate
5. Retainer
6. Body

Unit: mm

No.	Check item	Criteria					Remedy
9	Centring spring	Standard size			Repair limit		If damaged or deformed, replace spring.
		Free length x Outside diameter	Installation length	Installation load	Free length	Installation load	
		33.9 x 15.3	28.4	125 N {12.7 kg}	—	100 N {10.2 kg}	
10	Metering spring	22.7 x 8.10	22.0	16.7 N {1.70 kg}	—	13.3 N {1.36 kg}	

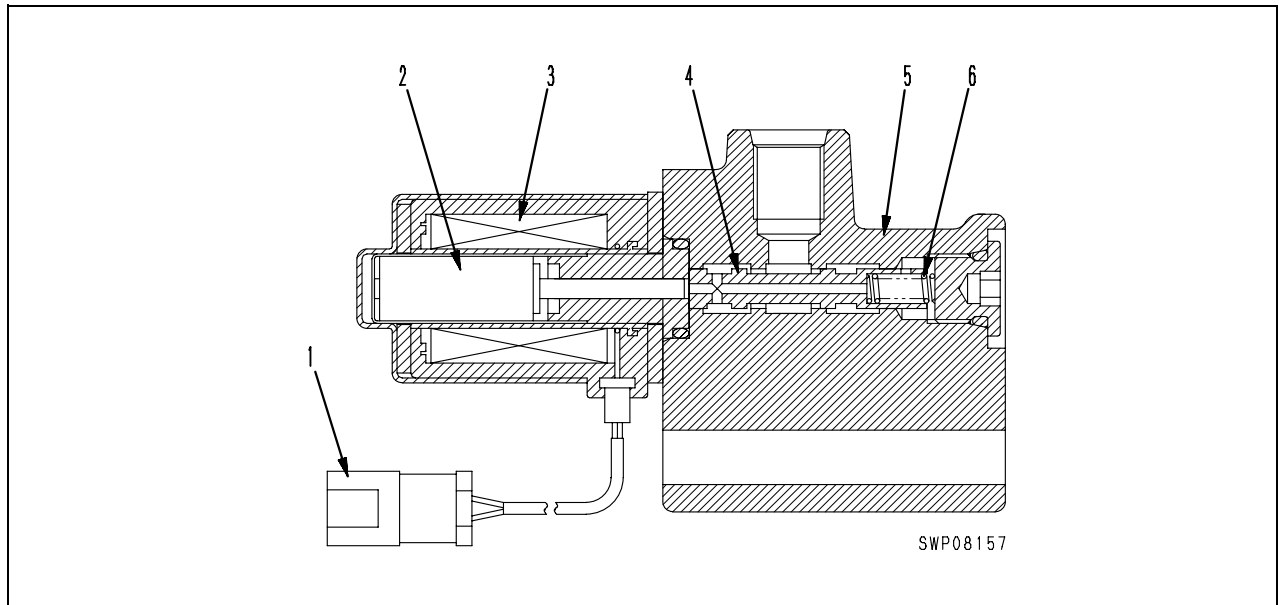
Solenoid valve

PPC lock, travel junction, merge-divider, travel speed, swing holding brake, 2-stage relief solenoid valves



1. PPC lock solenoid valve
2. Travel junction solenoid valve
3. Merge-divider solenoid valve
4. Travel speed solenoid valve
5. Swing holding brake solenoid valve
6. 2-stage relief solenoid valve

T : To tank
 A1 : To PPC valve
 A2 : To main valve (Travel junction valve)
 A3 : To main valve (Merge-divider valve)
 A4 : To both travel motors
 A5 : To swing motor
 A6 : To main valve (2-stage relief valve)
 P1 : From main pump
 ACC: To accumulator



1. Connector
2. Moving core
3. Coil
4. Cage

5. Spool
6. Block
7. Spring

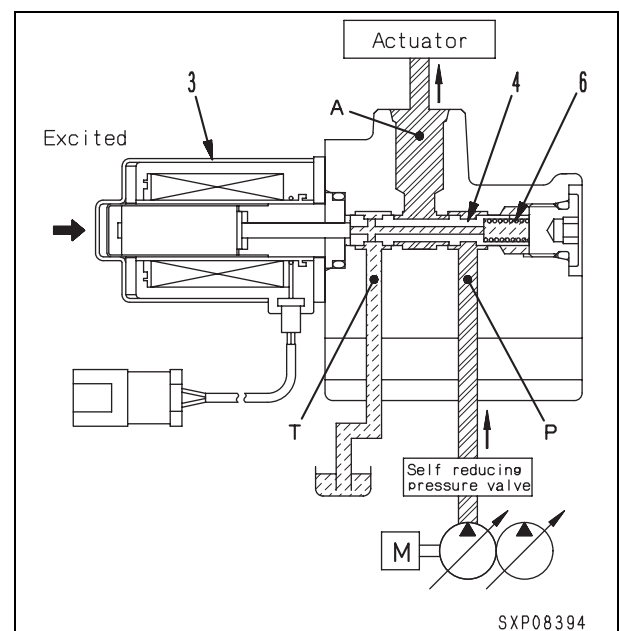
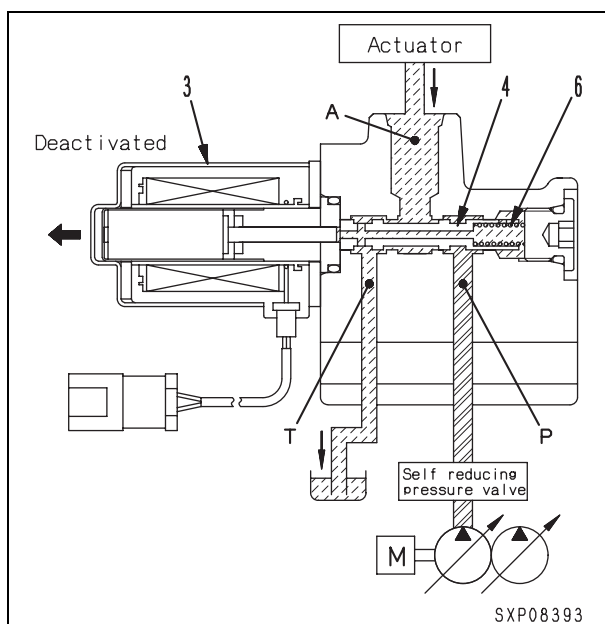
Operation

When solenoid is turned off

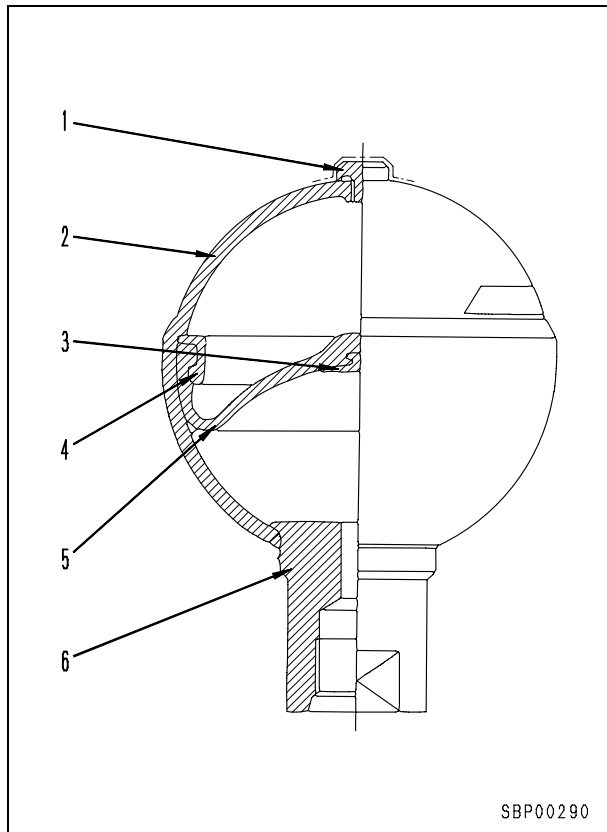
- Since the signal current does not flow from the controller, solenoid (3) is turned off. Accordingly, spool (4) is pressed by spring (6) against the left side. By this operation, the pass from (P) to (A) is closed and the hydraulic oil from the main pump does not flow into the actuator. At this time, the oil from the actuator is drained through ports (A) and (T) into the tank.

When solenoid is turned on

- The signal current flows from the controller to solenoid (3), and the latter is turned on. Accordingly, spool (4) is pressed against the right side. By this operation, the hydraulic oil from the main pump flows through port (P) and spool (4) to port (A), then flows into the actuator. At this time, port (T) is closed and the oil does not flow into the tank.



Accumulator



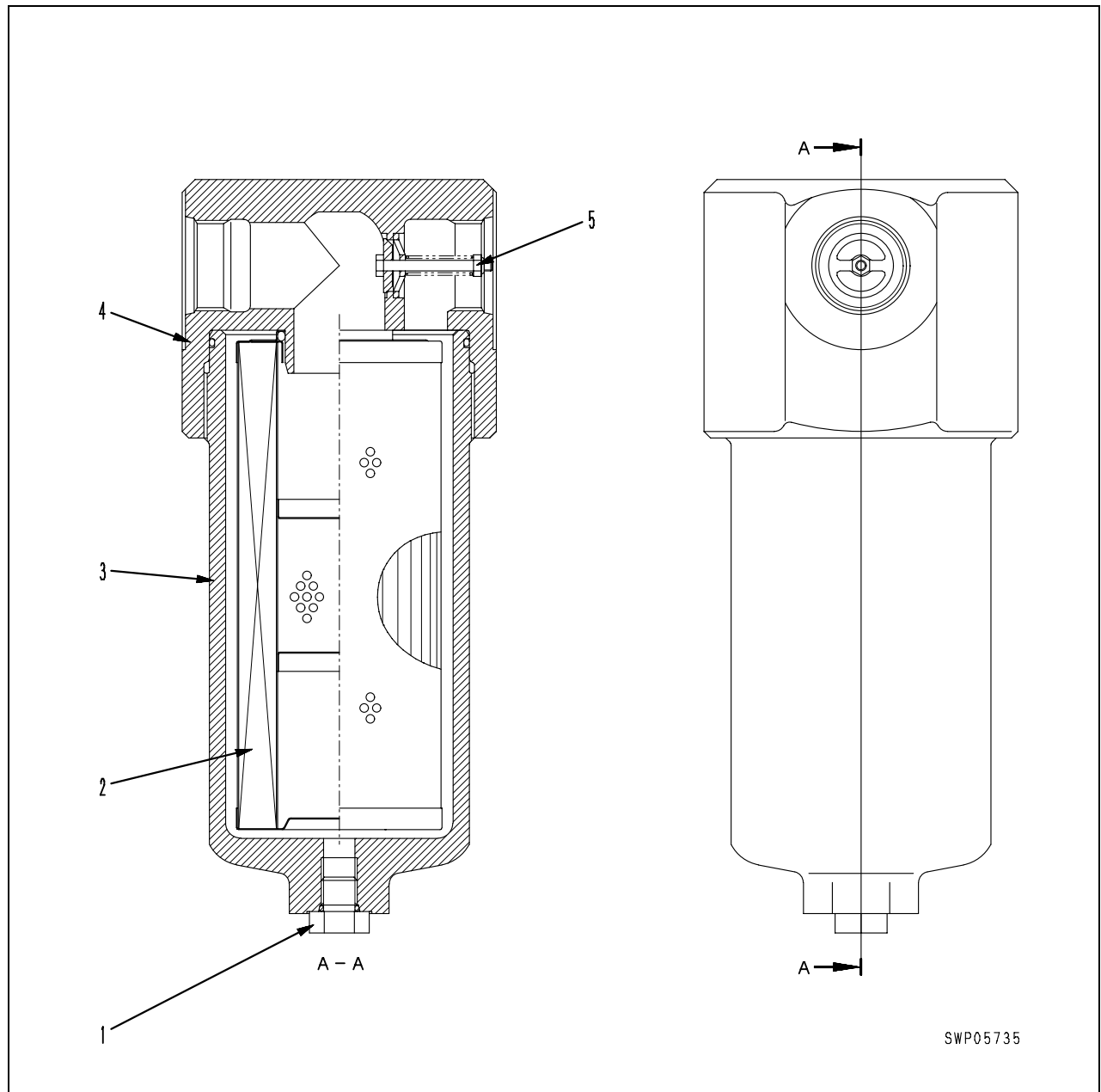
1. Gas plug
2. Shell
3. Poppet
4. Holder
5. Bladder
6. Oil port

Specifications

Gas capacity: 300 cc (for PPC)

Return oil filter

For Breaker

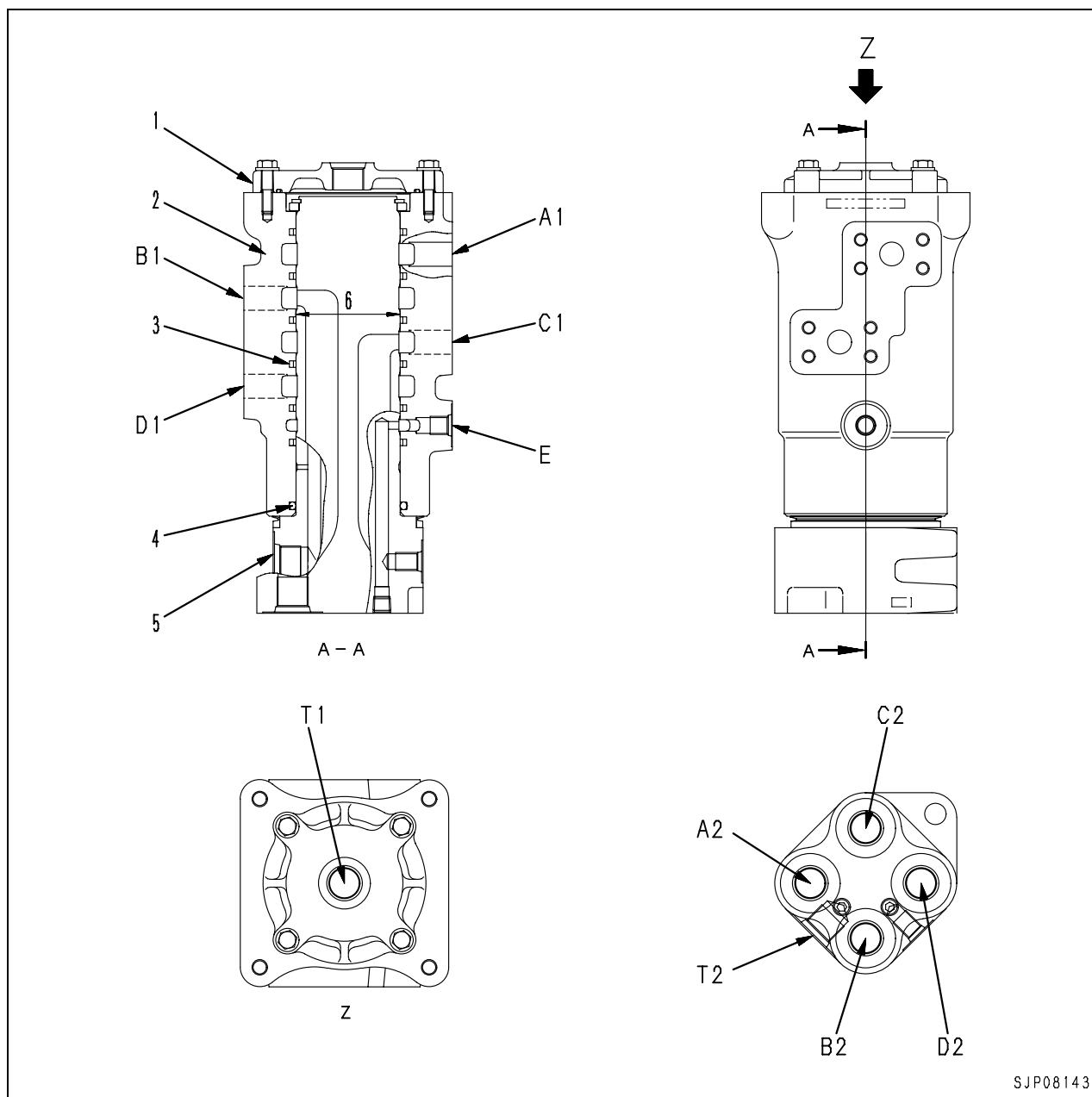


1. Drain plug
2. Filter
3. Case
4. Head cover
5. Relief valve

Specifications

Rated pressure : 6.9 MPa {70 kg/cm²}
 Flow : 200 ℓ/min
 Relief valve cracking pressure:
 0.34 ± 0.05 MPa
 {3.5 ± 0.5 kg/cm²}
 Filter mesh size : 6 μm
 Filtering area : 4,570 cm²

Centre swivel joint



1. Cover
2. Body
3. Slipper seal
4. O-ring
5. Shaft

A1 : To L.H. travel motor port (PB)
 A2 : From control valve port (A5)
 B1 : To L.H. travel motor port (PA)

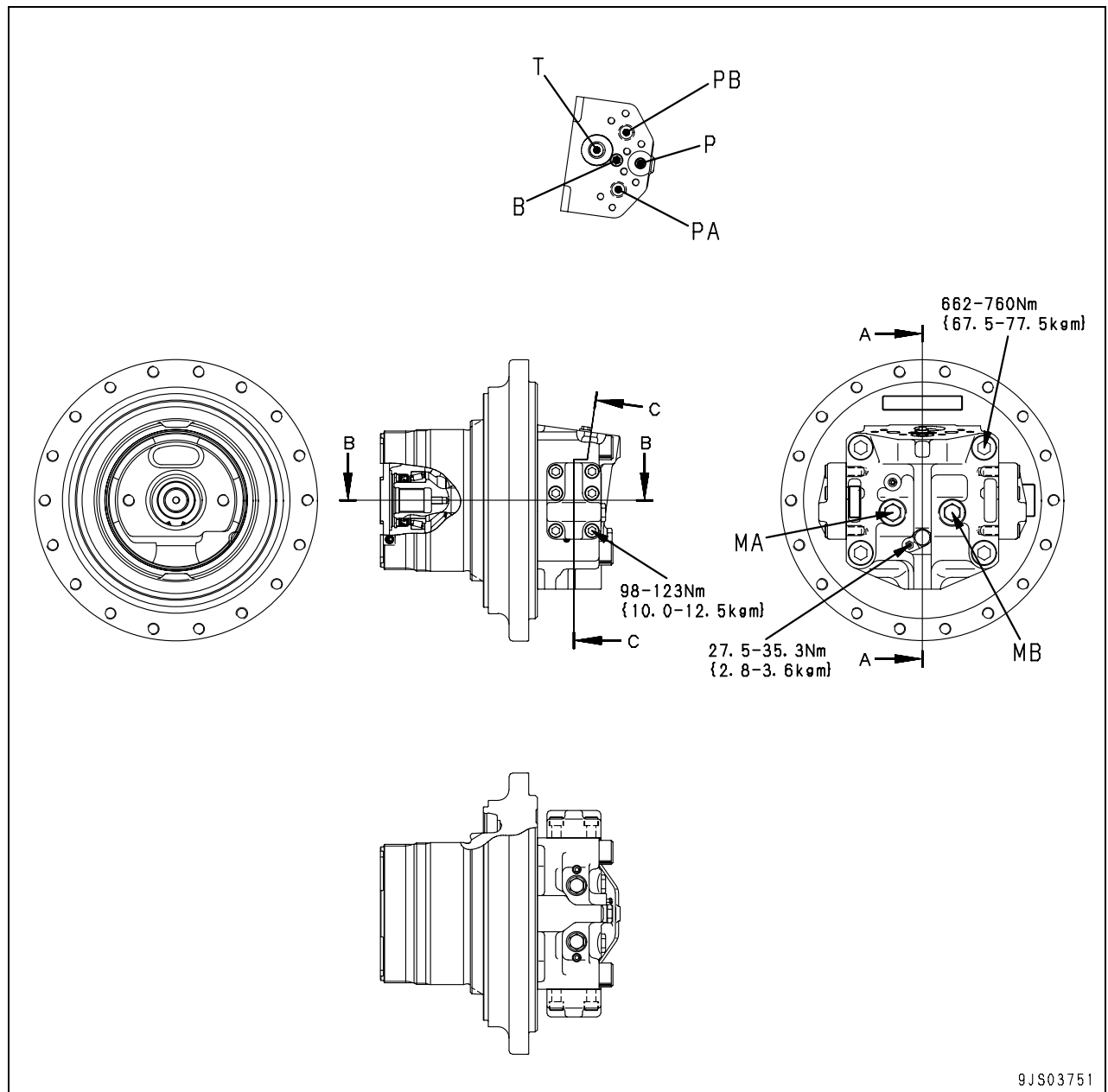
B2 : From control valve port (B5)
 C1 : To R.H. travel motor port (PA)
 C2 : From control valve port (A2)
 D1 : To R.H. travel motor port (PB)
 D2 : From control valve port (B2)
 E : To L.H. and R.H. travel motors port (P)
 T1 : From L.H. and R.H. travel motors port (T)
 T2 : To tank

Unit: mm

No.	Check item	Criteria			Remedy
		Standard size	Standard clearance	Repair limit	
6	Clearance between rotor and shaft	80	—	—	Replace

Travel motor

Type: HMV110ADT-3

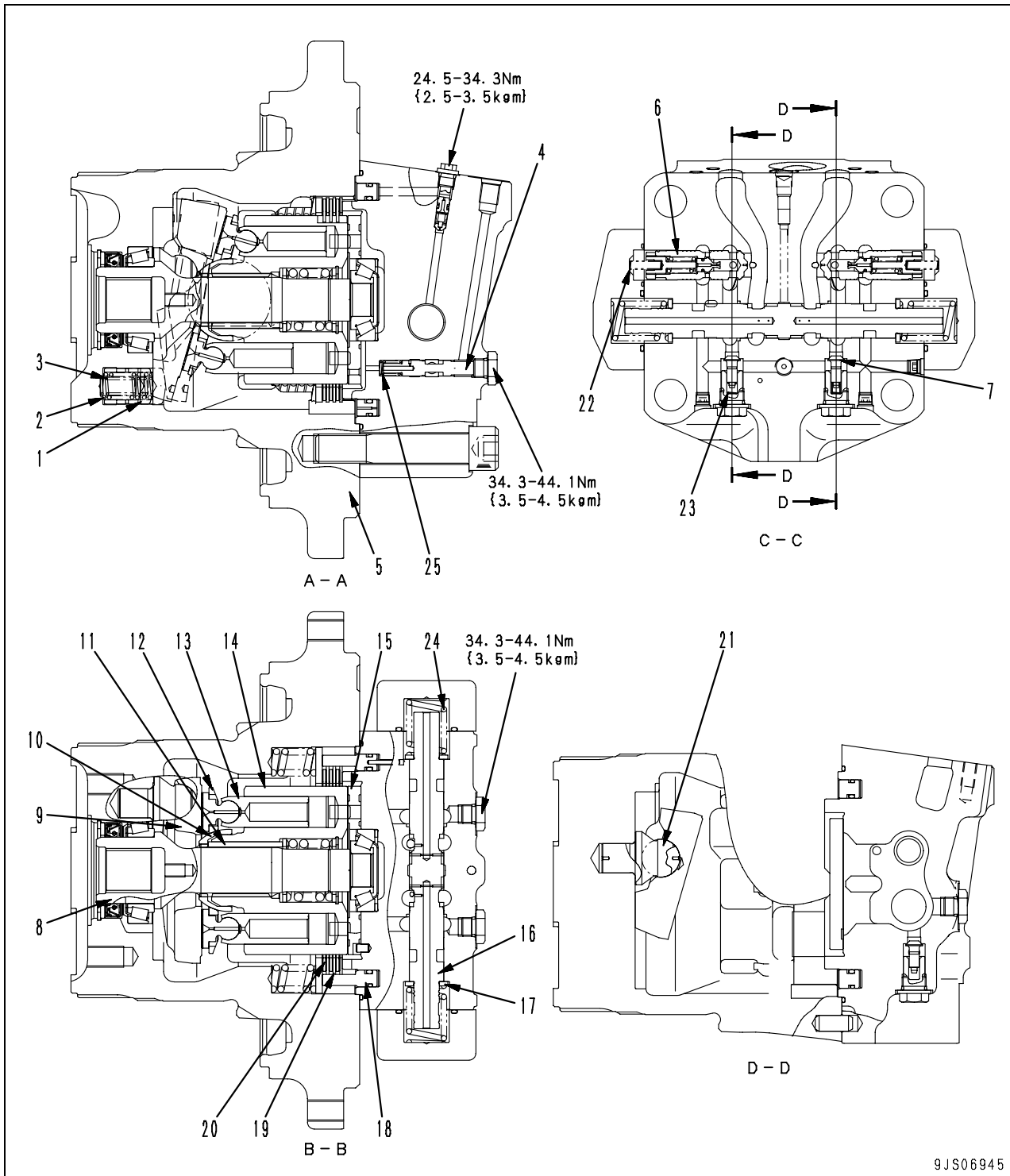


9JS03751

B : Brake release pressure port
 MA : MA pressure pick-up port
 MB : MB pressure pick-up port
 P : From travel speed solenoid valve
 PA : From control valve
 PB : From control valve
 T : To tank

Specifications

Type	: HMV110ADT-3
Theoretical delivery	
(Min.)	: 5.5 cm ³ /rev
(Max.)	: 95.4 cm ³ /rev
Rated pressure	: 37.3 MPa {380 kg/cm ² }
Rated speed	
(Min. capacity)	: 2,822 rpm
(Max. capacity)	: 1,627 rpm
Brake release pressure	: 1.2 MPa {12 kg/cm ² }
Travel speed switching pressure	
(Differential pressure):	0.8 MPa {8 kg/cm ² }



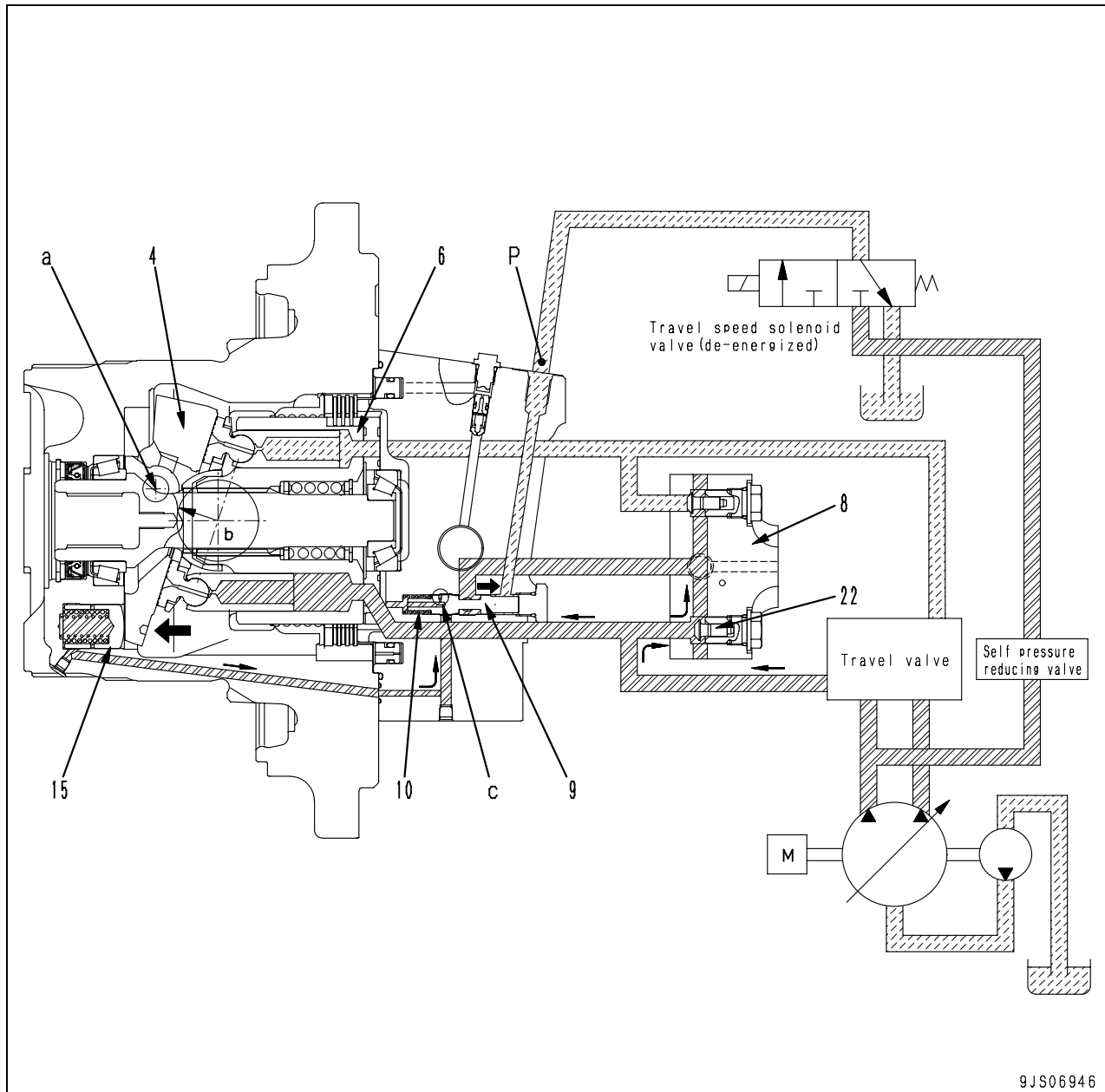
1. Regulator piston
2. Spring (Large)
3. Spring (Small)
4. Regulator valve
5. Motor case
6. Suction safety valve
7. Check valve
8. Output shaft
9. Rocker cam
10. Retainer guide
11. Pin
12. Retainer
13. Piston
14. Cylinder block
15. Valve plate
16. Counterbalance valve
17. Ring
18. Brake piston
19. Plate
20. Disc
21. Ball

Unit: mm

No.	Check item	Criteria					Remedy
22	Check valve spring	Standard size			Repair limit		If damaged or deformed, replace spring.
		Free length x Outside diameter	Installation length	Installation load	Free length	Installation load	
		32.5 x 6.5	24.2	7.16 N {0.73 kg}	—	5.69 N {0.58 kg}	
23	Check valve spring	13.0 x 6.5	9.5	1.96 N {0.2 kg}	—	1.57 N {0.16 kg}	
24	Spool return spring	58.4 x 30	42	427 N {43.5 kg}	—	341 N {34.8 kg}	
25	Regulator valve spring	21.5 x 11.1	17.1	54.9 N {5.6 kg}	—	43.9 N {4.48 kg}	

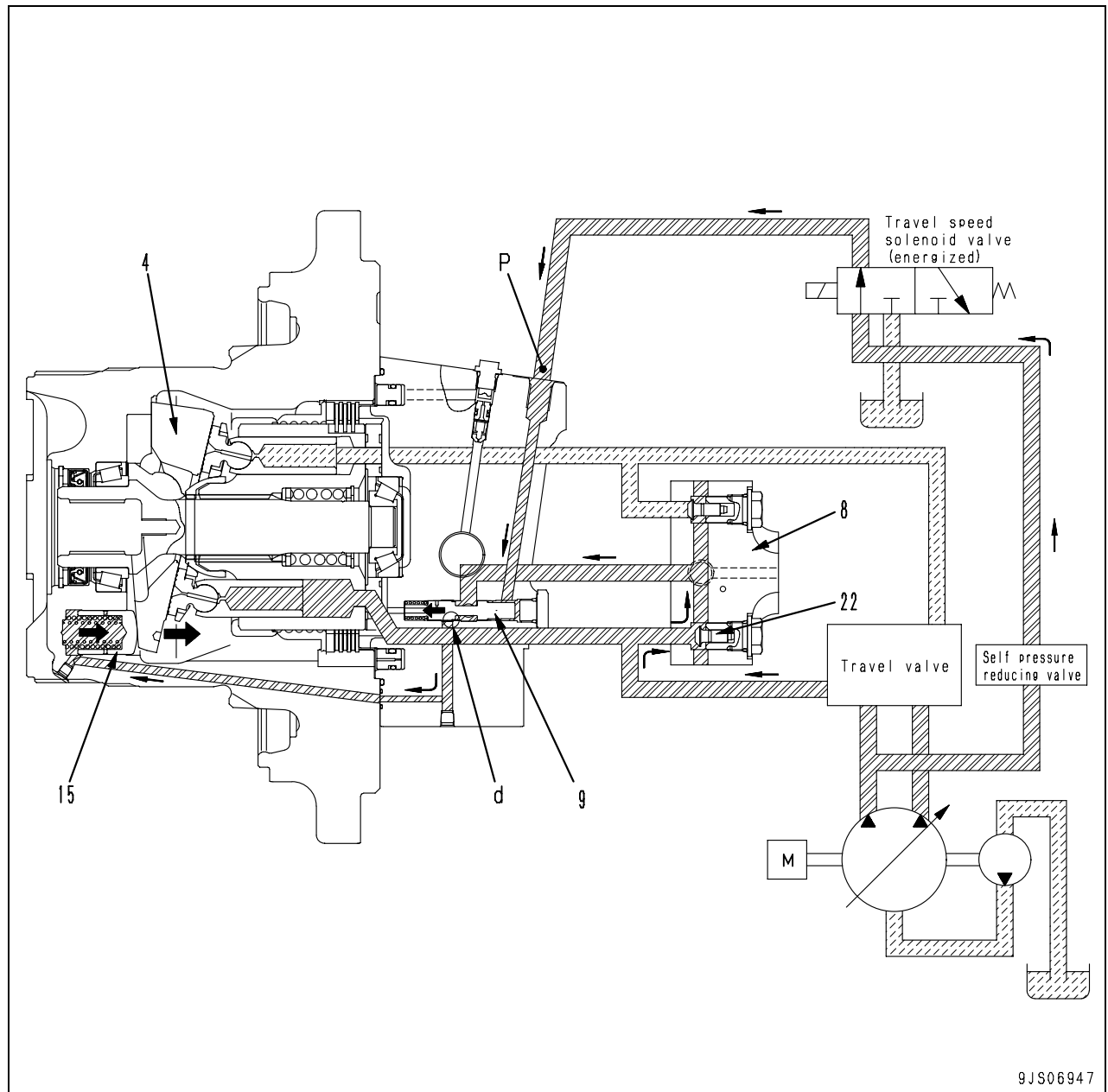
Operation of motor

1. At slow speed (motor swash plate angle at maximum)



- As the solenoid valve is de-energized, the pilot pressurized oil from the self pressure reducing valve does not flow to port (P).
- Regulator valve (9) is pushed to the right by spring (10).
- Pressurized oil being conducted from the control valve to end cover (8) by pressing check valve (22) is shut off by regulator valve (9).
- Fulcrum (a) of rocker cam (4) is eccentric to the working point (b) of the combined force of the propulsion force of cylinder (6).
- The combined force of the piston propulsion forces works as the moment of inclining rocker cam (4) toward the maximum swash plate angle.
- The pressurized oil at regulator piston (15) passes through orifice (c) of regulator valve (9) and is drained to the motor case.
- Rocker cam (4) is inclined in the maximum swash plate angle direction. The motor capacity becomes maximum, turning on the low speed travel.

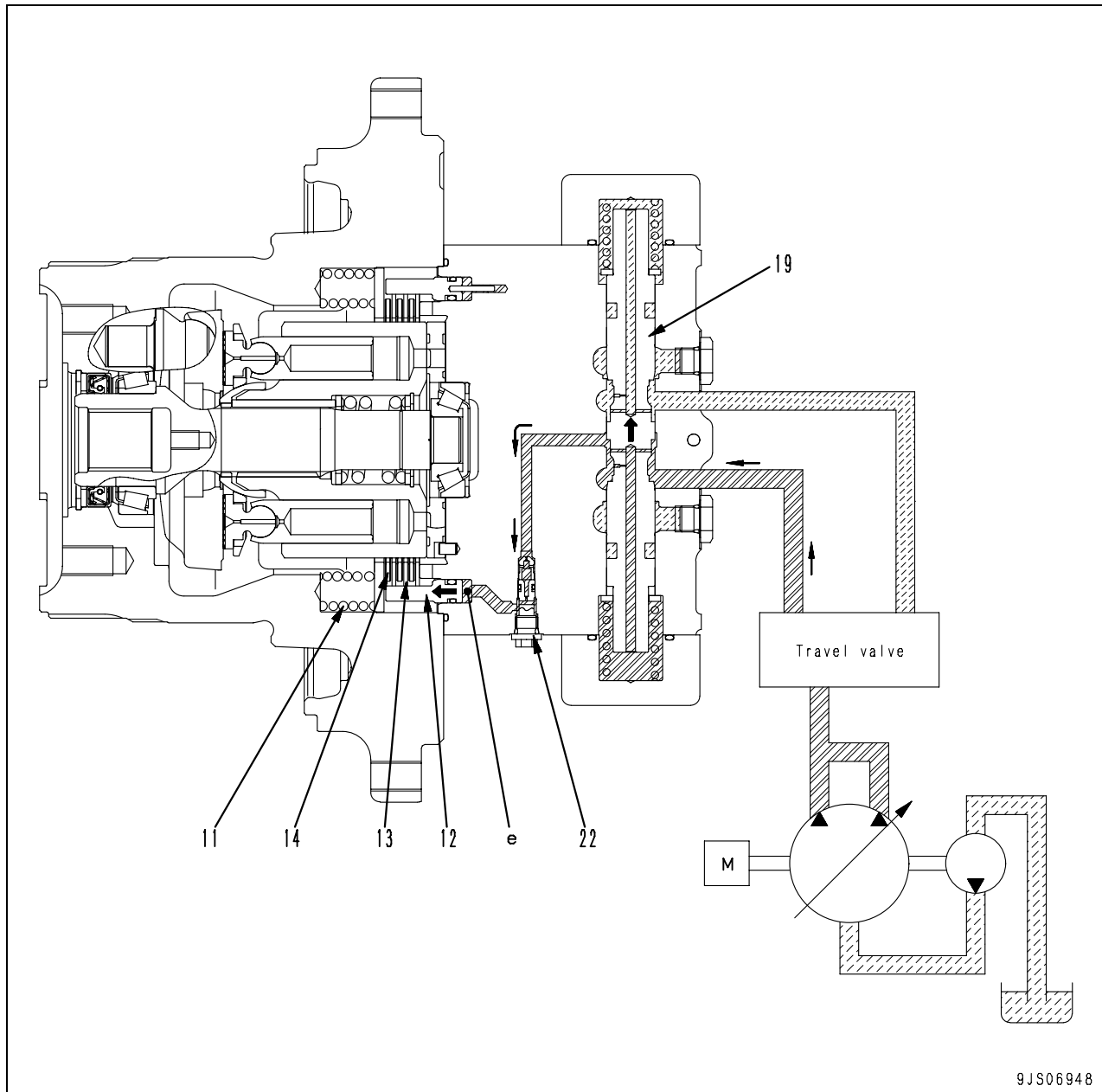
2. At high speed (motor swash plate angle at minimum)



- As the solenoid valve is energized, the pilot pressurized oil from the self pressure reducing valve flows to port (P).
- Regulator valve (9) is pushed to the left.
- The pressurized oil from the control valve passes through passage (d) in regulator valve (9) and enters regulator piston (15).
- Regulator piston (15) is pushed to the right.
- Rocker cam (4) is inclined in the minimum swash plate angle direction. The motor capacity becomes minimum, turning on the high speed travel.

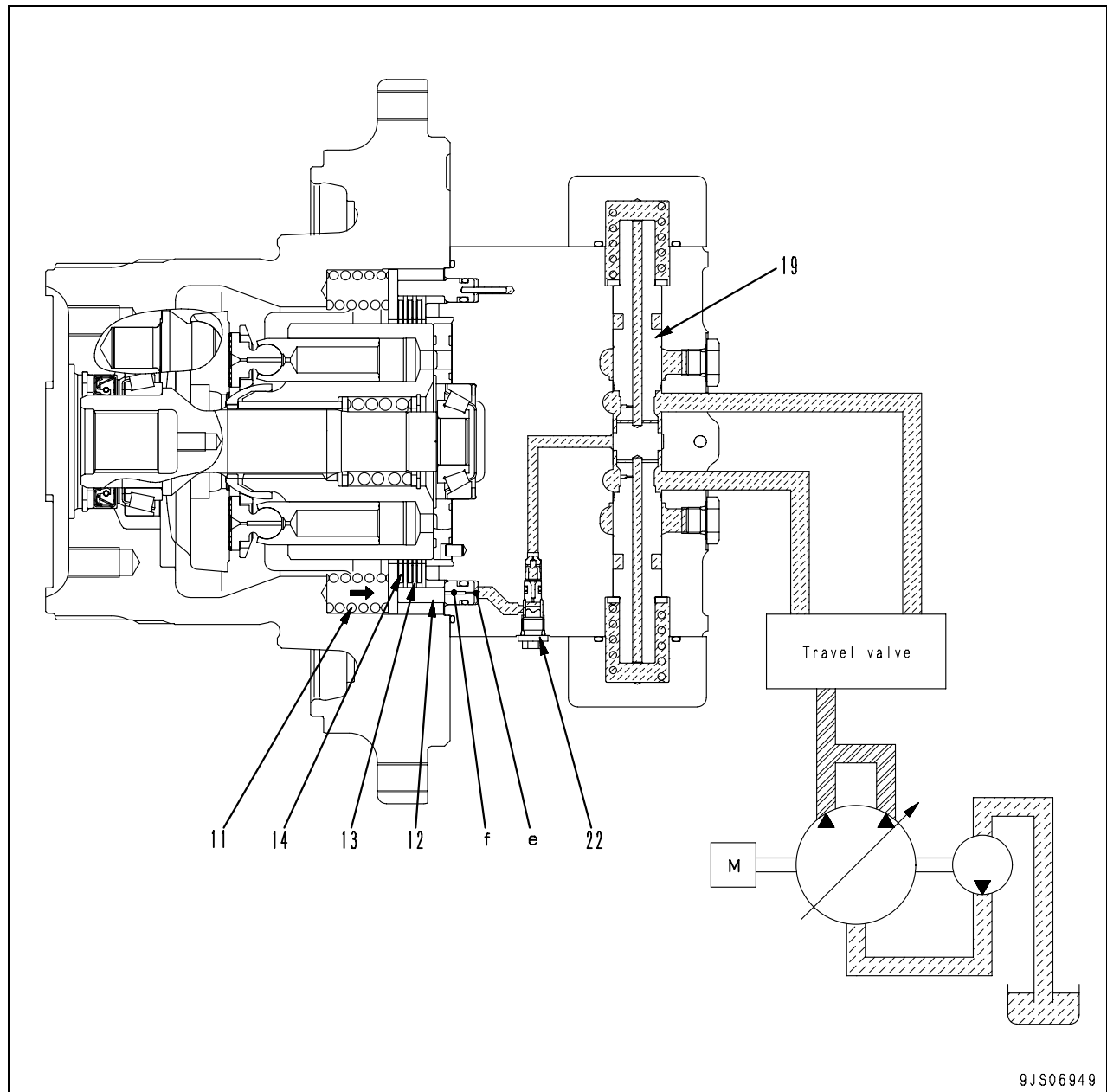
Operation of parking brake

1. When starting travel



- As the travel lever is operated, pressurized oil from the pump activates counterbalance valve spool (19), opening the parking brake circuit.
- The pressurized oil is conducted to chamber (e) of brake piston (12) and compresses spring (11), pushing piston (12) toward left.
- Since the pushing force to plate (13) and disc (14) disappears, plate (13) is separated from disc (14) and the brake is released.

2. When travel is stopped



- As the travel lever is placed in neutral, counterbalance valve spool (19) returns to the neutral position and closing the parking brake circuit.
- The pressurized oil in chamber (e) of brake piston (12) passes through orifice (f) of brake piston (12) and is drained to the motor case.
- Brake piston (12) is pushed to the right by spring (11).
- Plate (13) and disc (14) are pushed together, and the brake is applied.
- As brake piston (12) returns, flow of pressurized oil is reduced with slow return valve (22).
- The time delay will be set to activate the brake only after the machine has stopped.

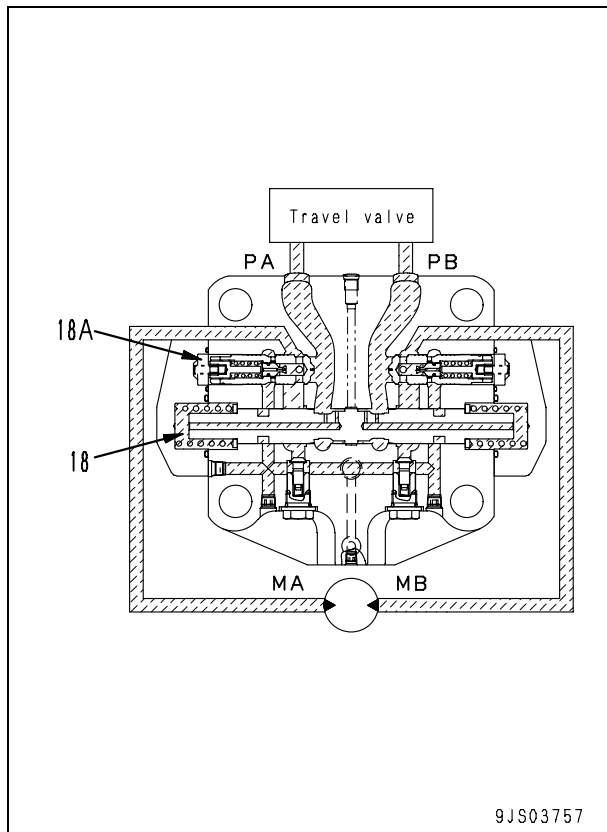
Brake valve

- The brake valve consists of suction safety valve (18A) and counterbalance valve (18).
- Functions and operations of respective components shall conform to the following.

1. Counterbalance valve and check valve

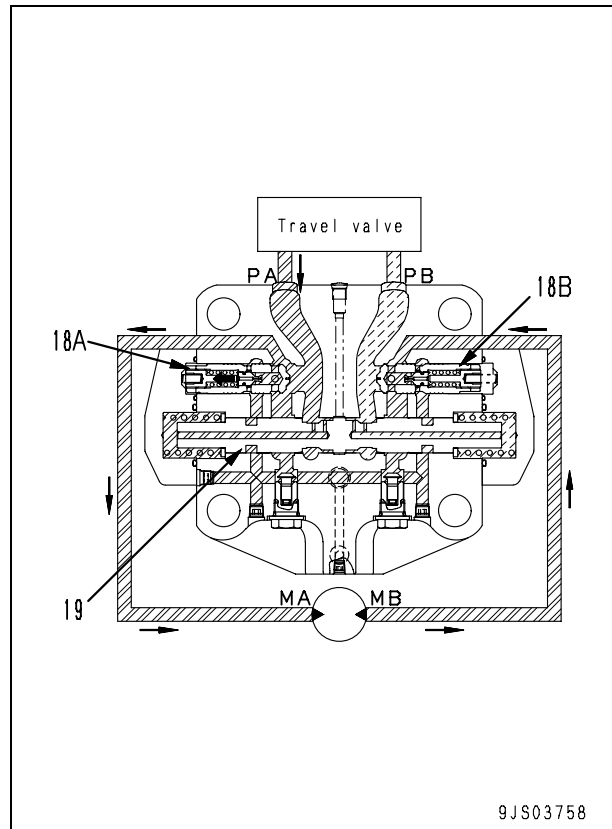
Function

- When travelling downhill, the machine travel speed tends to get faster than the motor (engine) speed because of the downward force generated from its own weight.
- If the machine travels with the engine at low speed, the motor may rotate without load, resulting in run away and inviting a very dangerous situation.
- These valves are used to prevent above by controlling the machine to travel according to the engine speed (pump delivery).

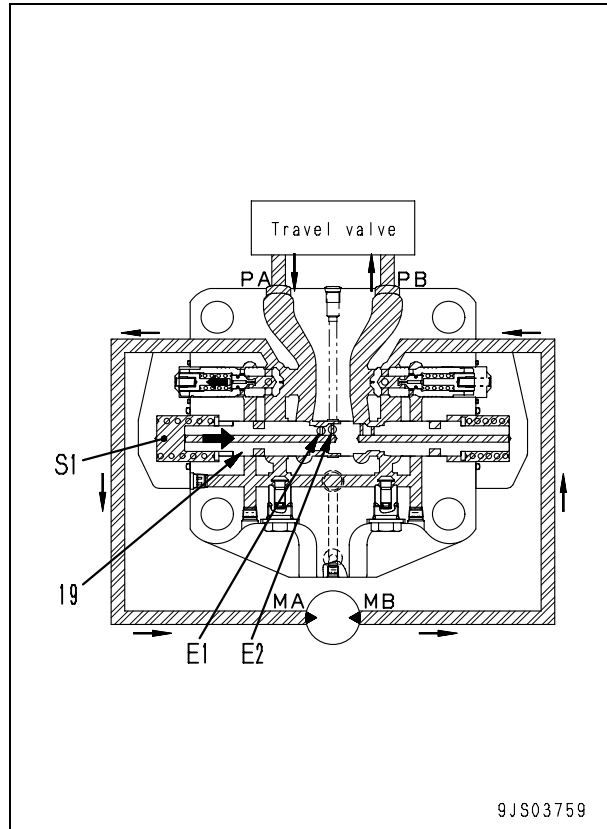


Operation when pressurized oil is supplied

- Operating the travel lever conducts the pressurized oil from the control valve to port (PA).
- The pressurized oil push-opens suction safety valve (18A) and then flows to motor inlet port (MA) through motor inlet port (MA).
- The motor outlet side is closed by suction safety valve (18B) and spool (19), so the pressure at the supply side rises.

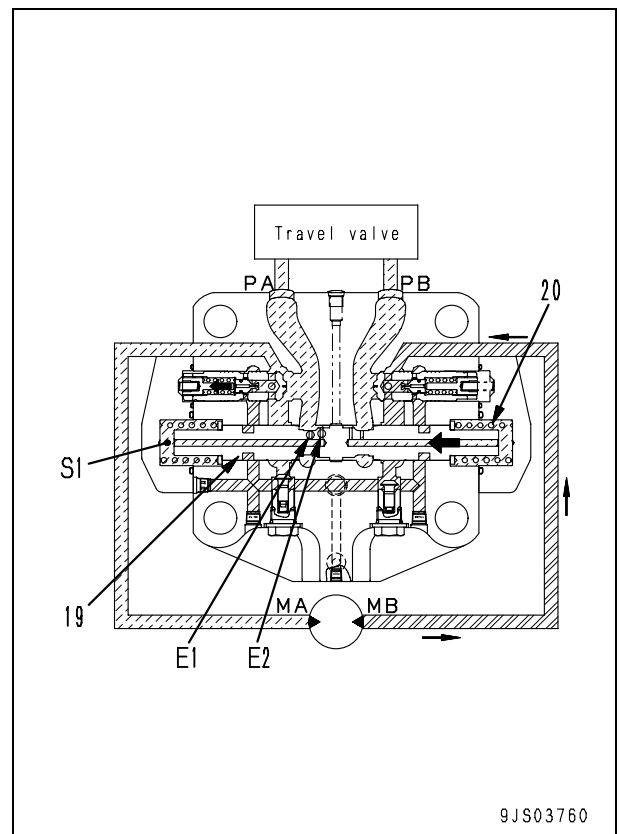


- The pressurized oil on the supply side flows to chamber (S1) through orifice (E1) and orifice (E2) of the spool (19).
- As the pressure in chamber (S1) goes above the spool selector pressure, spool (19) is pushed toward right.
- Port (MB) and port (PB) are connected, opening the motor outlet port side and starting the motor rotating.



Operation of brake during travelling downhill

- If indication of the machine runaway is sensed while travelling downhill, the motor will be caused to rotate without load to decrease the inlet side oil pressure.
- Pressure in chamber (S1) is released through orifices (E1) and (E2).
- As the pressure in chamber (S1) goes below the spool selector pressure, spool (19) is returned to the left by spring (20) and outlet port (MB) is throttled.
- The pressure at the outlet port side rises, generating rotation resistance on the motor to prevent the machine from running away.
- The spool moves to a position where the pressure on outlet port (MB) can be balanced against the machine's own weight and the inlet port pressure.
- Oil flow from the outlet circuit is reduced to ensure the travel speed corresponded to the pump delivery.



2. Safety valve

Function

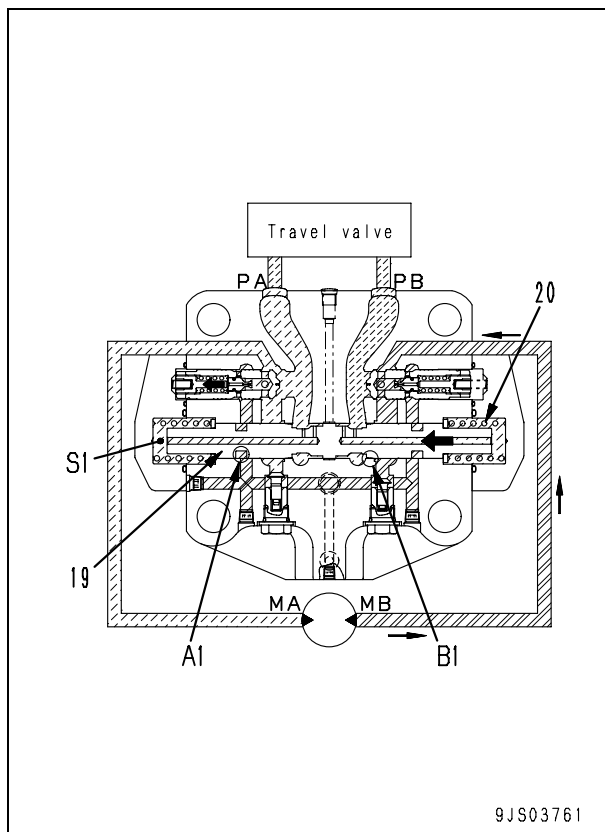
- As long as the machine travel is stopped (or it is travelling downhill), the counterbalance valve closes the inlet and outlet circuits of the motor.
- Since the motor is rotated by inertial force, pressure in the motor outlet port side is abnormally increased, potentially resulting in damages on the motor and piping.
- The safety valve releases this abnormal pressure to the inlet port side of the motor in order to prevent damages to the equipment.

Operation

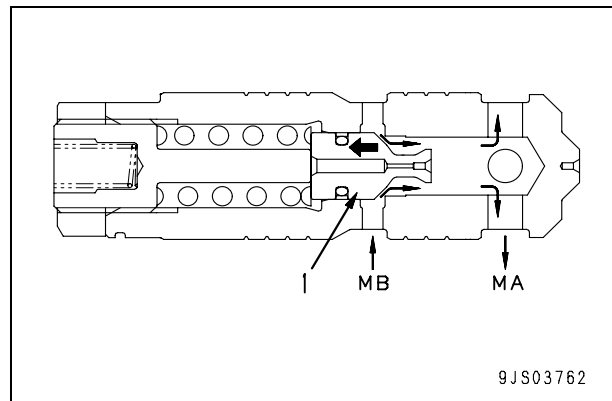
1) When travel is stopped

(or when travelling downhill) (Right swing)

- Reduction of the pressure at motor inlet (PA) decreases the pressure in chamber (S1).
- When it drops beyond the spool switching pressure, spool (19) is returned to the left by spring (20), reducing the pressure at outlet passage (B1).
- The motor tries to continue rotation resorting to inertial force, thus pressure on the outlet port (MB) is increased.



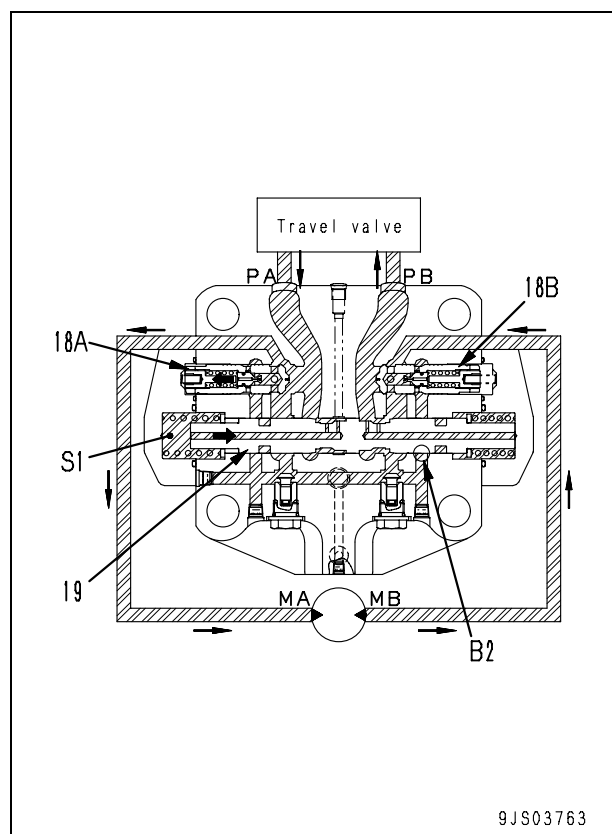
- When the pressure rises above the set pressure of the suction safety valve, poppet (1) opens.
- The pressurized oil passes through notch (A1) of spool (19) into chamber (MA) of the circuit at the opposite side.
- At the time of counter clockwise rotation, it makes reverse operation of clockwise rotation.



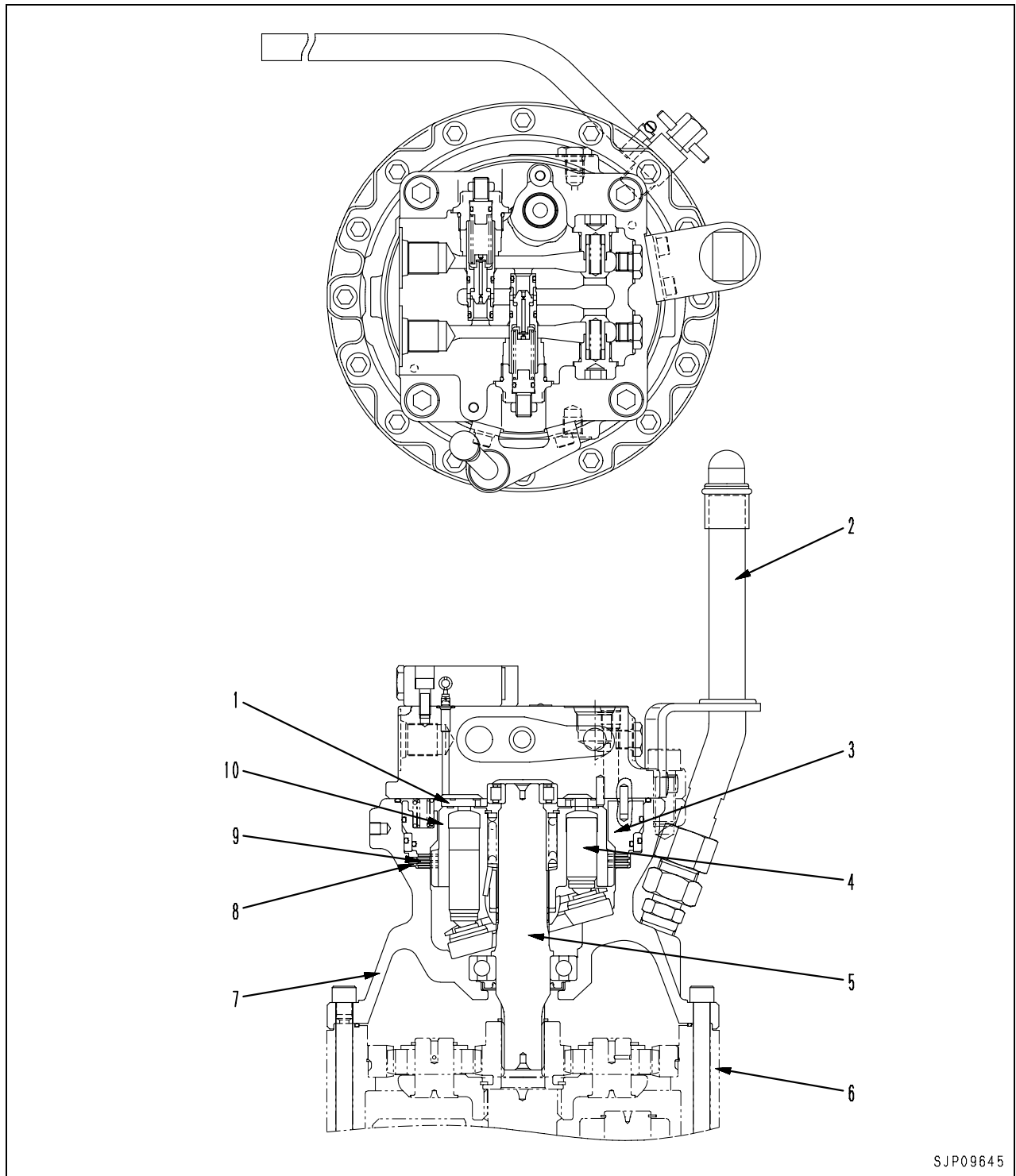
2) When starting travel

(or when travelling at a constant speed)

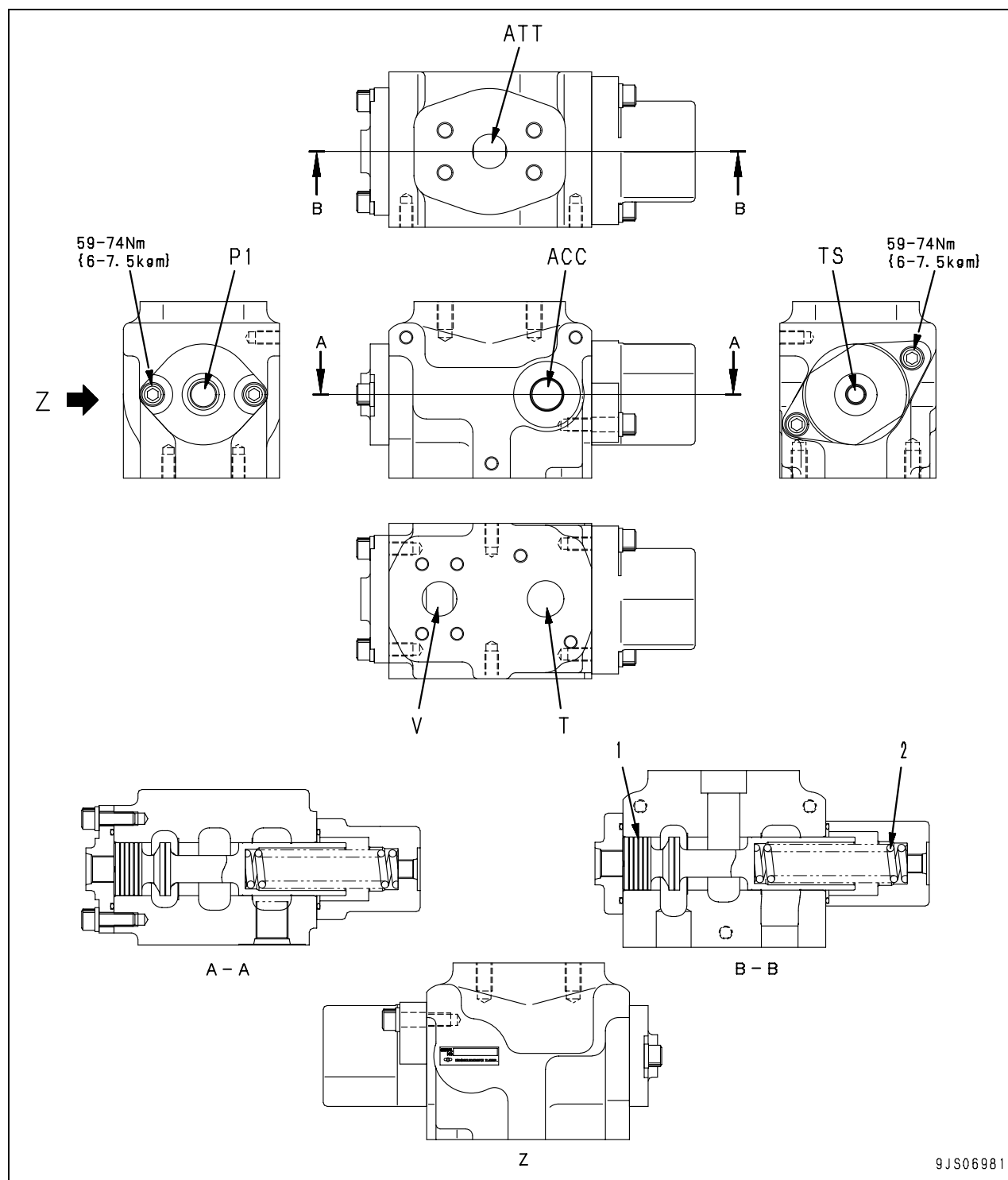
- As the travel lever is operated, the pressurized oil from the pump moves spool (19) toward right.
- The passage to the suction safety valve functions as a circuit which passes through notch (B2) of spool (19), producing large differential pressure.
- The pump pressure rises, providing a large tractional force to the valve.



Swing motor



Attachment circuit selector valve



ACC: To accumulator
 ATT : To attachment
 P1 : From attachment selector solenoid valve
 T : To hydraulic tank
 TS : To hydraulic tank
 V : To control valve

1. Spool

Unit: mm

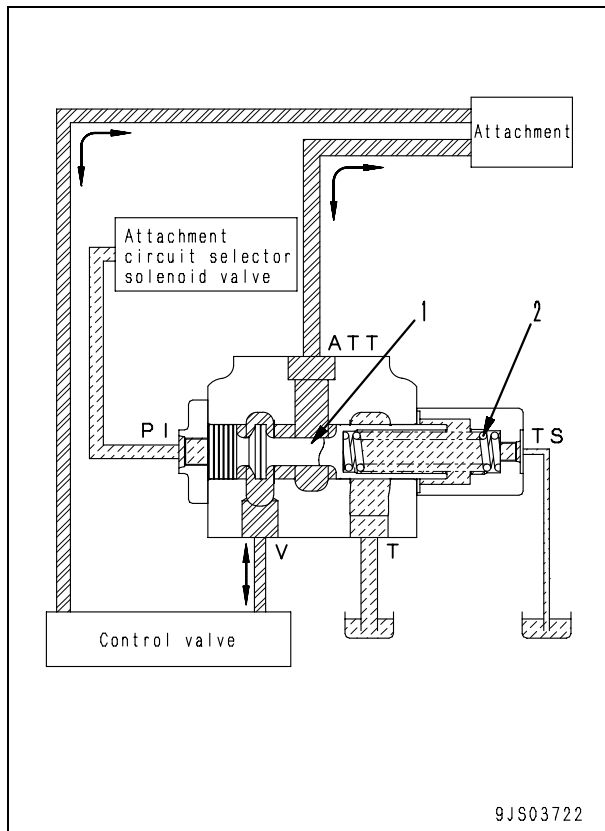
No.	Check item	Criteria					Remedy
2	Spool return spring	Standard size			Repair limit		If damaged or deformed, replace spring.
		Free length x Outside diameter	Installation length	Installation load	Free length	Installation load	
		132 x 29	114.5	834 N {85.0 kg}	—	667 N {68.0 kg}	

Function

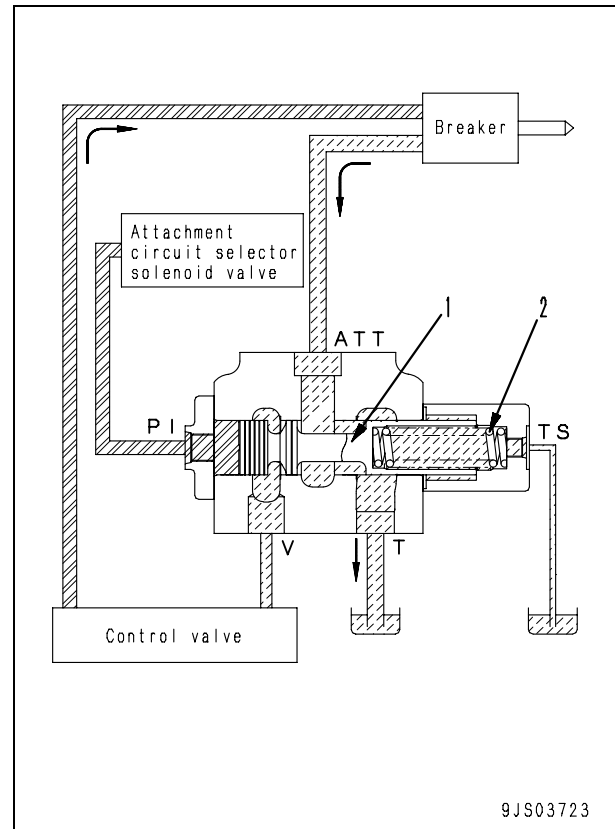
- When a breaker is installed, the return oil from the breaker does not pass through the main valve, but returns directly to the hydraulic tank.
- When other attachments (crusher, etc.) are installed, the attachment and the main valve are interconnected.

Operation**1. When attachment other than breaker is installed**

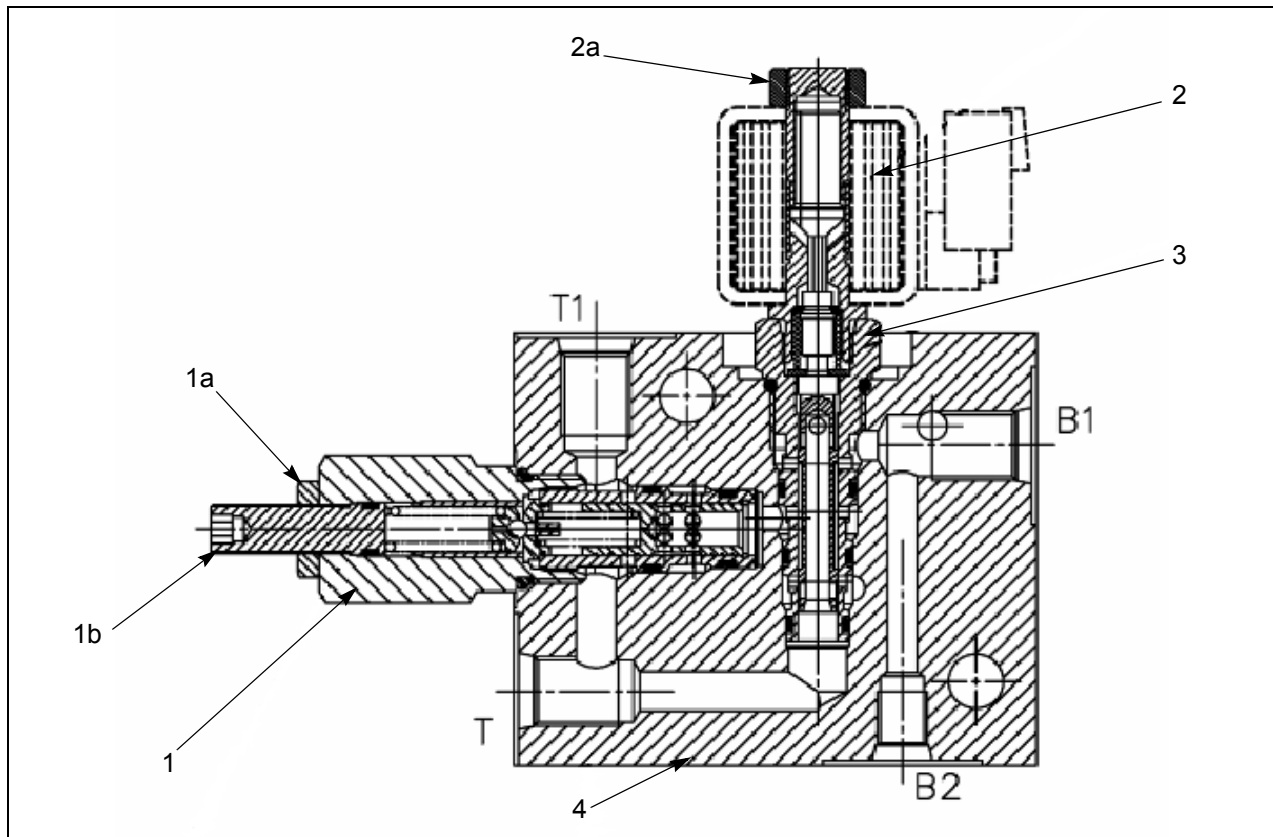
- Spool (1) is pressed to the left by the force of spring (2).
- Ports (ATT) and (V) are interconnected and ports (ATT) and (T) are shut off. Attachment is thus interconnected to the control valve.

**2. When breaker is installed**

- Pilot pressure from the attachment circuit selector solenoid valve contracts spring (2), and spool (1) moves to the right to the stroke end.
- Ports (ATT) and (V) are shut off and ports (ATT) and (T) are interconnected.
- Pressurized oil returning from the breaker returns directly to the hydraulic tank through port (T) without passing through the control valve.



Quick coupler control valve



- 1 Pressure regulating valve
- 1a Lock nut
- 1b Adjustment screw
- 2 Solenoid
- 2a Nut
- 3 Directional control valve
- 4 Block

Specification

Min set pressure: 1MPa (10.2 kg/cm²).

Max set pressure 30+/-5 Mpa (306+/-51kg/cm²)

Flow: 120l/min.

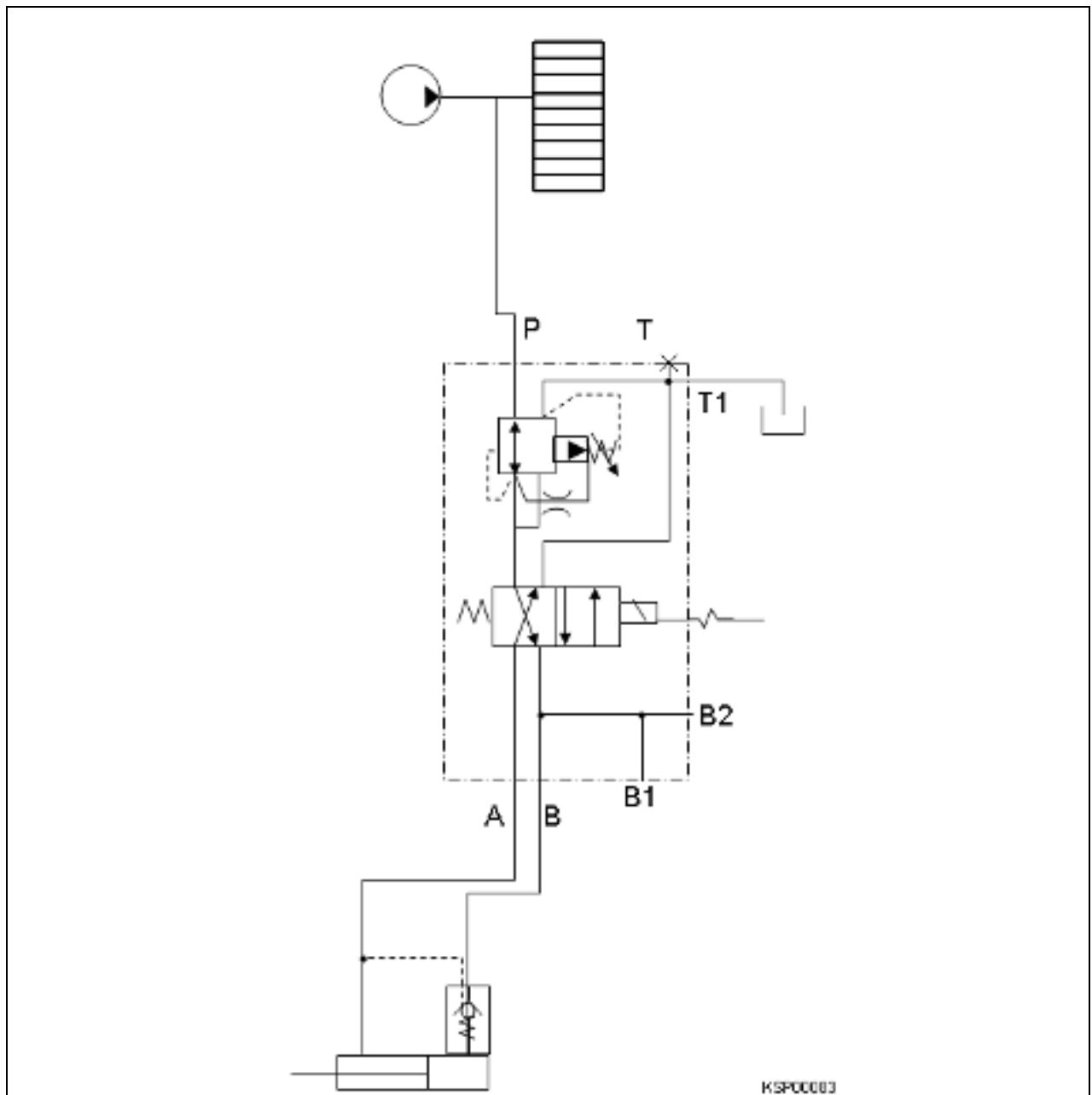
Operation

1. When solenoid is switched OFF
 - Since the signal from the operation switch (Op Cab RHS Console) is off, solenoid (2) is de-energised. For this reason, directional control valve (3) is in the default position and oil will flow from port P to port B.
 - Oil returning from the quick coupler will flow from port A to port T.
 - The setting of the pressure regulating valve (1) will determine the maximum pressure at port B. When the stroke end of

the quick coupler cylinder is reached the pressure at the cylinder will be the set pressure of the regulating valve(1).

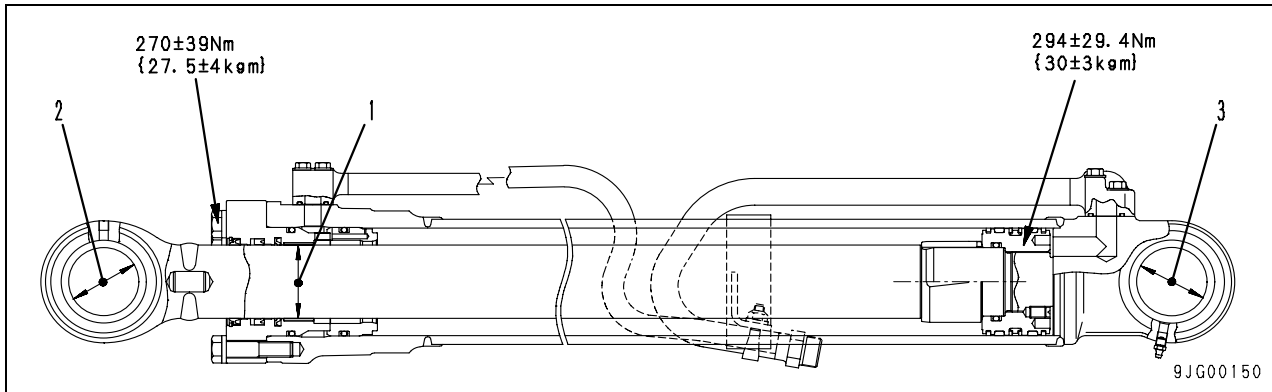
- The pressure regulating valve can be adjusted according to the specification of the coupler. The minimum setting is 1MPa and the maximum setting is 30+5MPa.
2. When solenoid is switched ON
 - When the switch (Op Cab RHS Console) is on current will flow to the solenoid (2) energising it. Accordingly, the directional control valve (3) will move upwards and oil will flow from port P to port A.
 - Oil returning from the quick coupler will flow from port B to port T.
 - The setting of the pressure regulating valve (1) will determine the maximum pressure at port A. When the stroke end of the quick coupler is reached the pressure at the cylinder will be the set pressure of the regulating valve (1).

Schematic

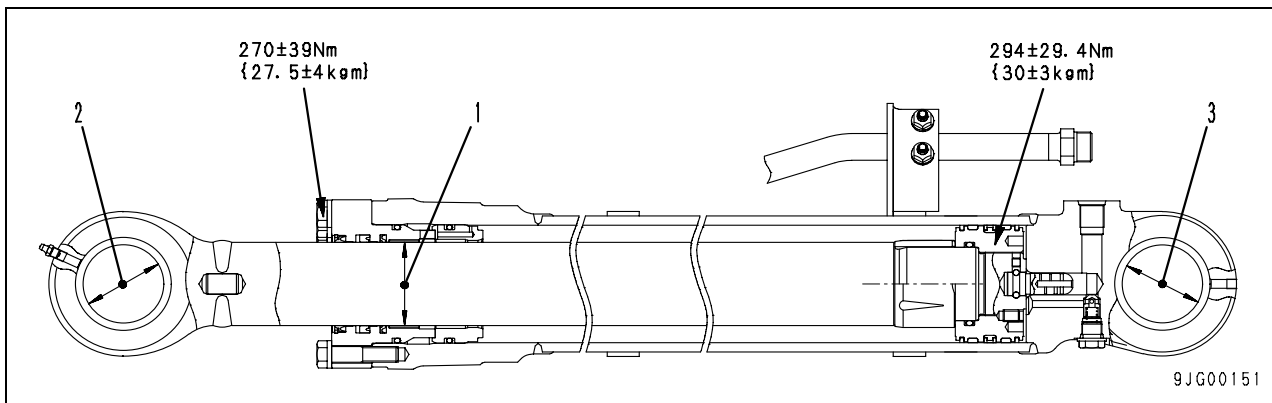


Hydraulic cylinder

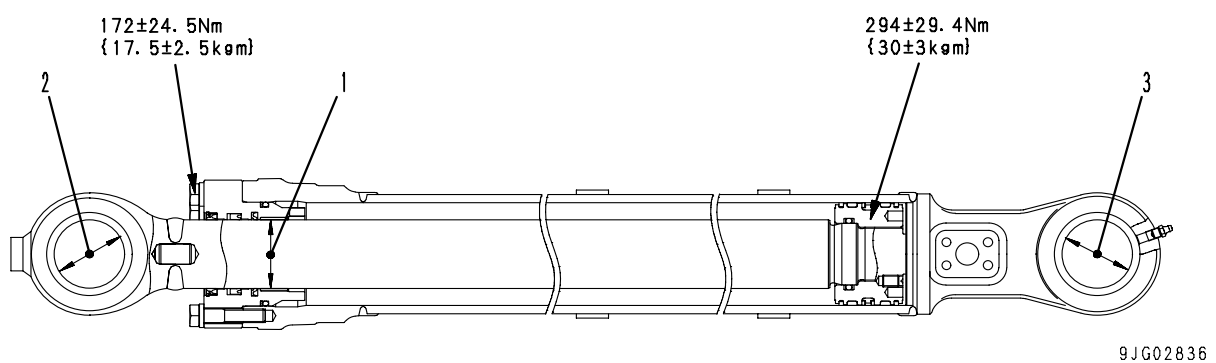
Boom cylinder



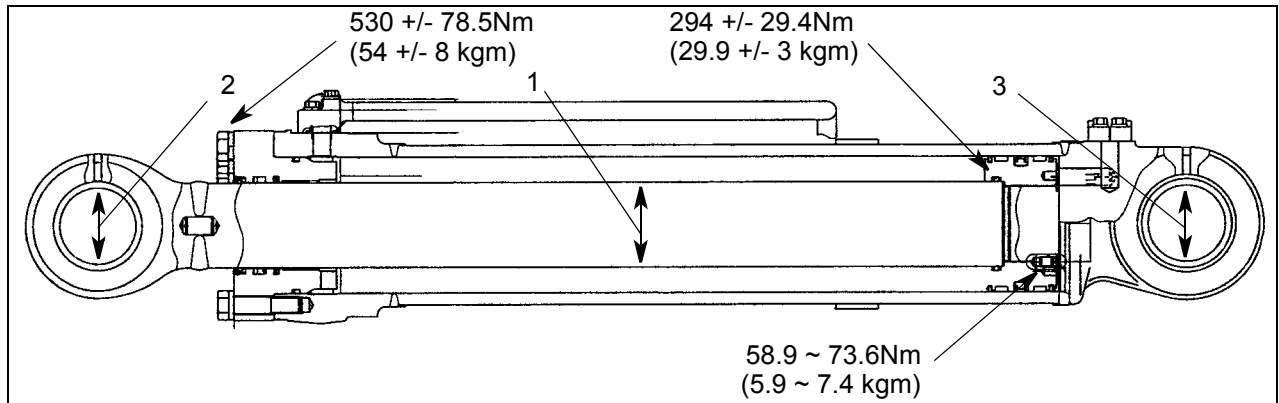
Arm cylinder



Bucket cylinder



Adjust Cylinder



Unit: mm

No.	Check item	Criteria						Remedy
1	Clearance between piston rod and bushing	Cylinder	Standard size	Tolerance		Standard clearance	Repair limit	Replace bushing
				Shaft	Hole			
		Boom (1 PB)	75	- 0.030 - 0.076	+ 0.279 + 0.065	0.096 - 0.355	0.445	
		Boom (2 PB)	85	- 0.036 - 0.090	+ 0.222 + 0.047	0.083 - 0.312	0.445	
		Arm	85	- 0.036 - 0.090	+ 0.222 + 0.047	0.083 - 0.312	0.445	
		Bucket	70	- 0.030 - 0.076	+ 0.259 + 0.063	0.093 - 0.335	0.445	
2	Clearance between piston rod support pin and bushing	Adjust	90	- 0.036 - 0.090	+ 0.257 + 0.048	0.078 - 0.347	0.445	Replace pin or bushing
		Boom (1 PB)	70	- 0.030 - 0.060	+ 0.190 + 0.070	0.100 - 0.250	1.0	
		Boom (2 PB)	80	- 0.030 - 0.060	+ 0.190 + 0.070	0.100 - 0.250	1.0	
		Arm	80	- 0.030 - 0.076	+ 0.175 + 0.075	0.105 - 0.251	1.0	
		Bucket	70	- 0.030 - 0.076	+ 0.170 + 0.070	0.100 - 0.246	1.0	
3	Clearance between cylinder bottom support pin and bushing	Adjust	90	- 0.036 - 0.090	+ 0.190 + 0.070	0.106 - 0.280	1.0	
		Boom (1 PB)	70	- 0.030 - 0.060	+ 0.190 + 0.070	0.100 - 0.250	1.0	
		Boom (2 PB)	70	- 0.030 - 0.060	+ 0.190 + 0.070	0.100 - 0.250	1.0	
		Arm	80	- 0.030 - 0.076	+ 0.175 + 0.075	0.105 - 0.251	1.0	
		Bucket	70	- 0.030 - 0.060	+ 0.170 + 0.070	0.100 - 0.230	1.0	
		Adjust	90	- 0.036 - 0.090	+ 0.190 + 0.070	0.106 - 0.280	1.0	

PC160LC-7E0, PC180LC/NLC-7E0 Hydraulic excavator

Form No. UEN01967-01

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HYDRAULIC EXCAVATOR

PC160LC-7E0

PC180LC-7E0

PC180NLC-7E0

Machine model	Serial number
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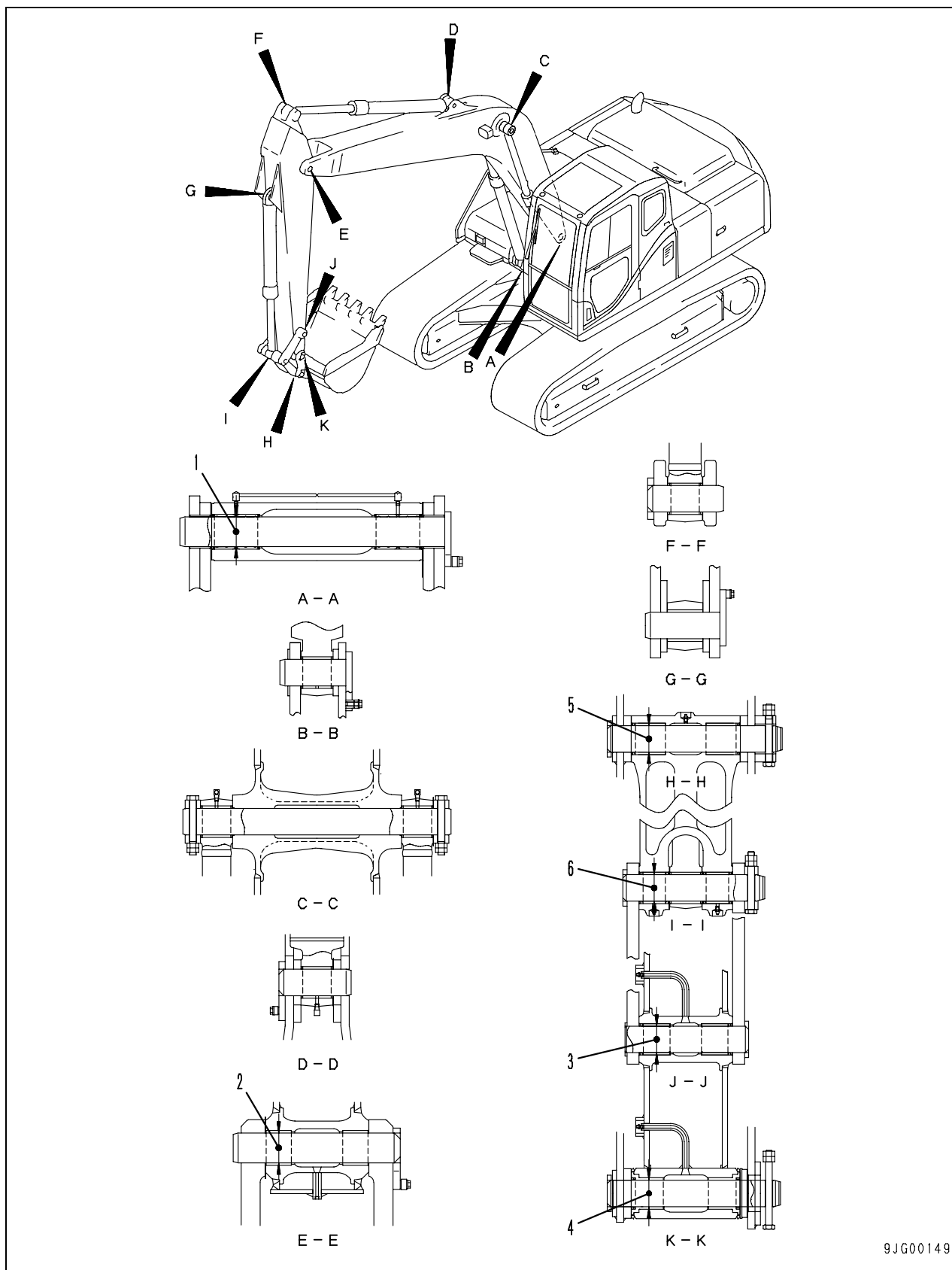
PC160LC-7E0	K45001 and up
PC180LC-7E0	K45001 and up
PC180NLC-7E0	K45001 and up

10 Structure, function and maintenance standard

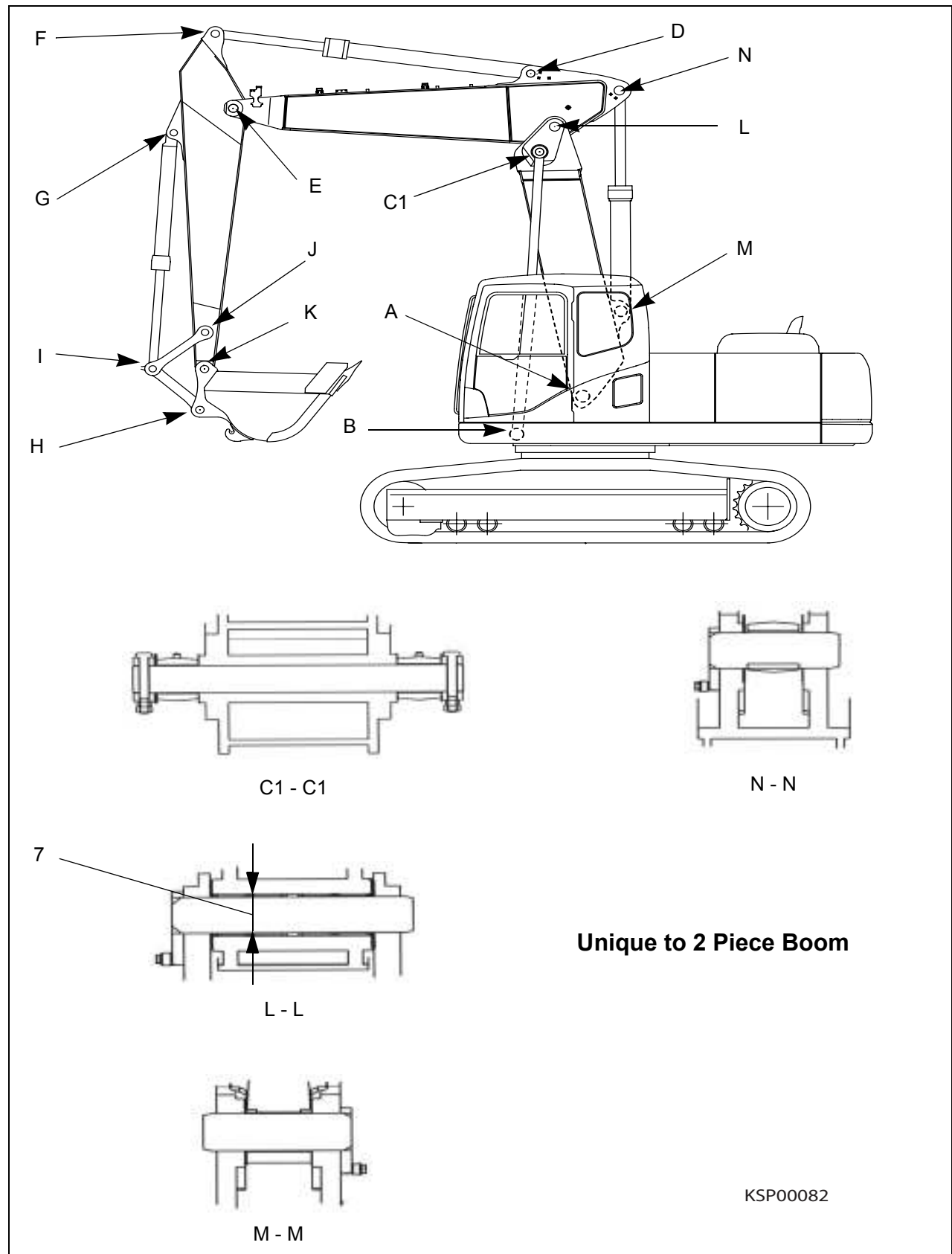
Work equipment

Work equipment.....	2
Work equipment (2 Piece Boom)	3
Dimensions of components.....	6

Work equipment



Work equipment (2 Piece Boom)

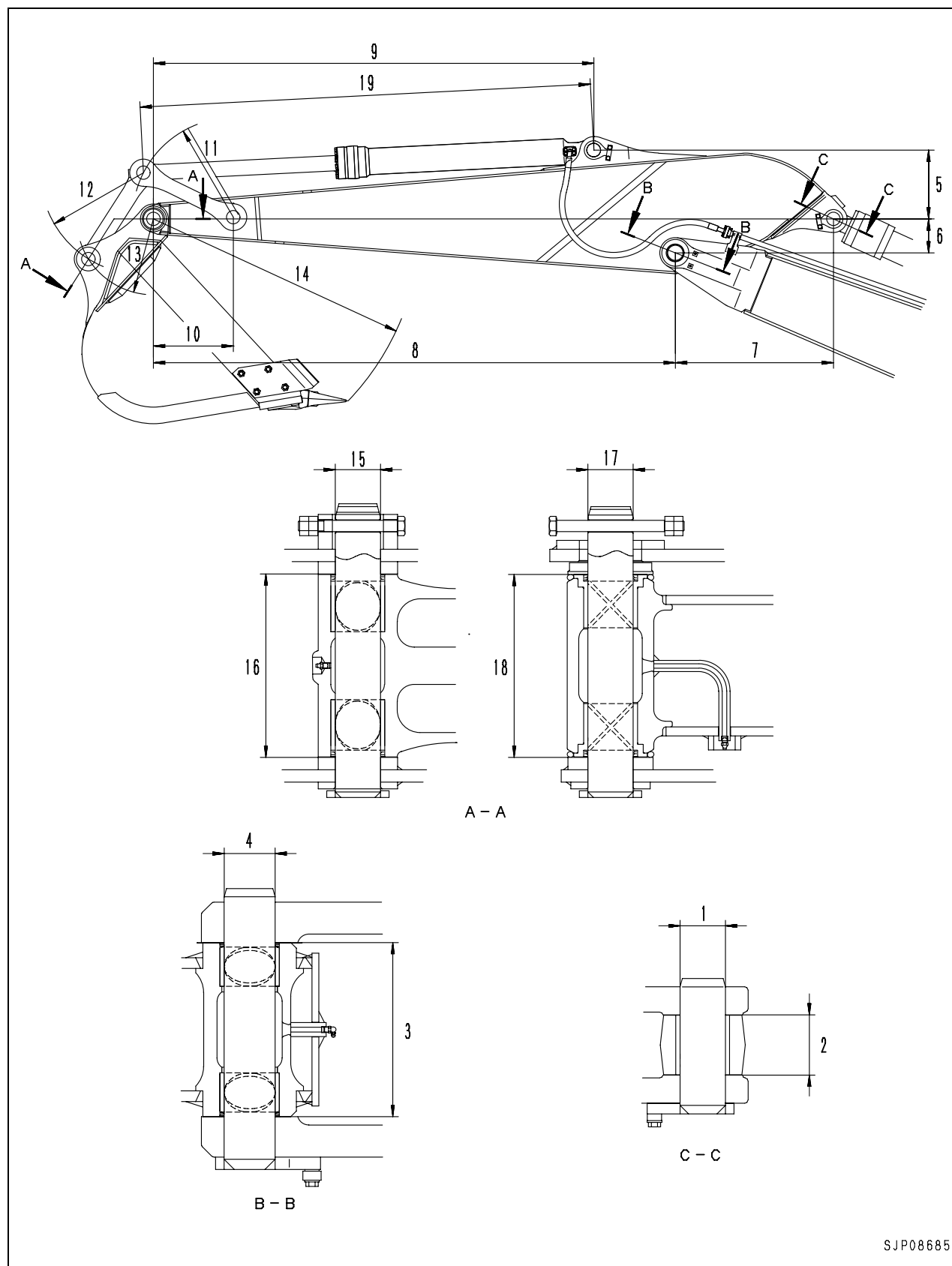


Unit: mm

No.	Check item	Criteria					Remedy
1	Clearance between connecting pin and bushing of revolving frame and boom	Standard size	Tolerance		Standard clearance	Clearance limit	Replace
			Shaft	Hole			
		80	-0.030 -0.060	+0.134 +0.074	0.104 – 0.194	1.0	
2	Clearance between connecting pin and bushing of boom and arm	80	-0.030 -0.060	+0.151 +0.091	0.121 – 0.211	1.0	
3	Clearance between connecting pin and bushing of arm and link	70	-0.030 -0.076	+0.158 +0.078	0.108 – 0.234	1.0	
4	Clearance between connecting pin and bushing of arm and bucket	70	-0.030 -0.076	+0.135 +0.074	0.104 – 0.211	1.0	
5	Clearance between connecting pin and bushing of link and bucket	70	-0.030 -0.076	+0.157 +0.078	0.108 – 0.233	1.0	
6	Clearance between connecting pin and bushing of link and link	70	-0.030 -0.076	+0.154 +0.074	0.104 – 0.230	1.0	
7	Clearance between connecting pin and bushing of 2nd boom	90	-0.036 -0.071	+0.135 +0.074	0.104 – 0.206	1.0	

Dimensions of components

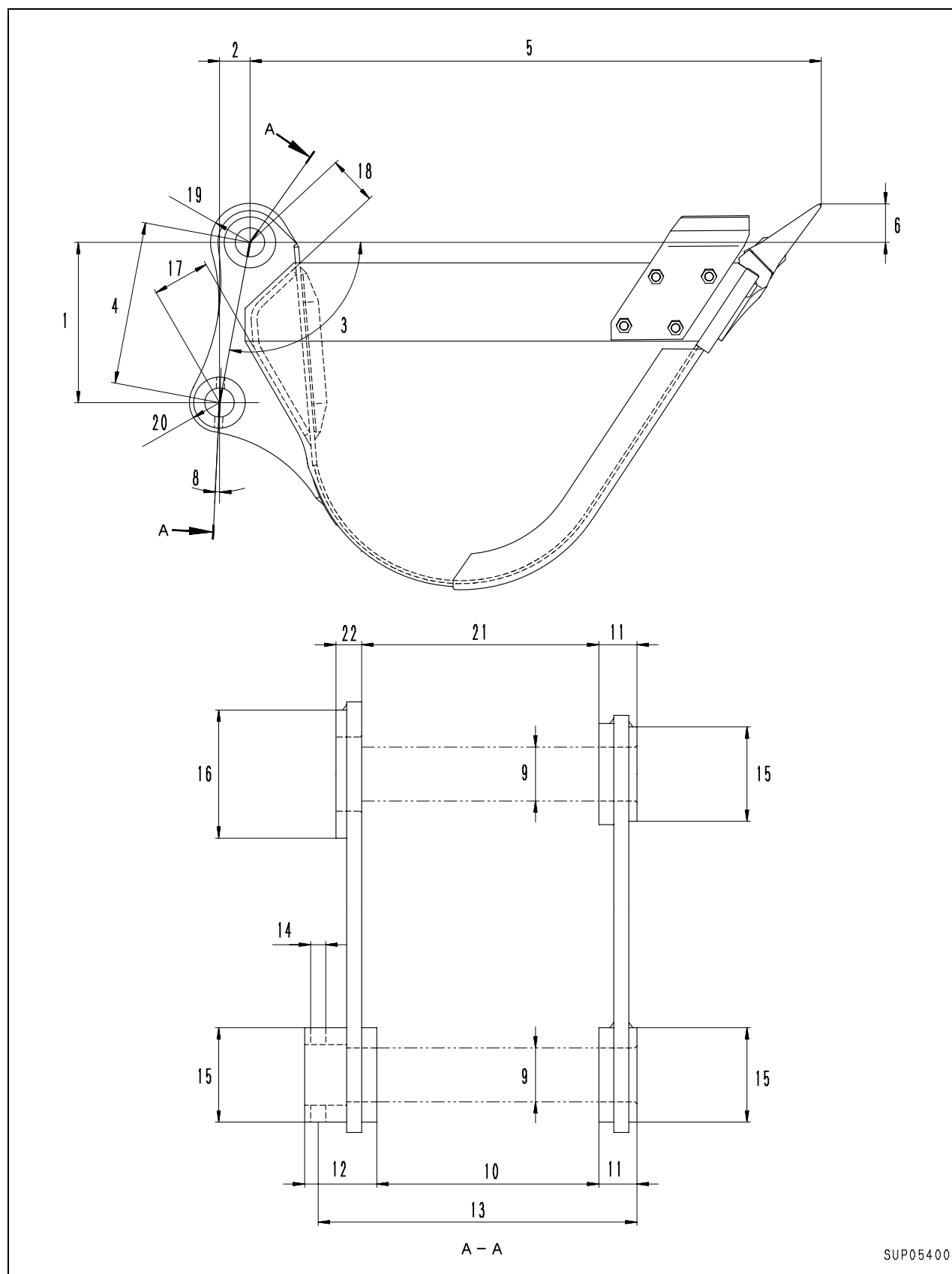
1. Dimension of arm



Unit: mm

No. \ Model		PC160LC-7E0, PC180LC-7E0 and PC180NLC-7E0
1		$\varnothing 80^{+0.1}_0$
2		$99.3^{+1.5}_0$
3		$286^0_{-0.5}$
4		$\varnothing 80^{-0.030}_{-0.060}$
5		414.7 ± 1.0
6		196.3 ± 0.5
7		747.4 ± 1.0
8		2,603
9		$2,001.7 \pm 1.0$
10		330 ± 1.0
11		583 ± 0.5
12		524 ± 0.5
13		400.8
14		1,347
15		$\varnothing 70$
16		311.5 ± 1.0
17		$\varnothing 70$
18	Arm as individual part	$276^0_{-0.5}$
	When press fitting bushing	310
19	Min.	1,501
	Max.	2,528

2. Dimension of bucket



Unit: mm

No. \ Model	PC160LC-7E0, PC180LC-7E0 and PC180NLC-7E0
1	400.5 ± 0.5
2	14.8 ± 0.5
3	97° 7'
4	400.8
5	1,334.7
6	180.7
7	—
8	0
9	$\varnothing 70^{+0.2}_0$
10	311.5 ± 1
11	50
12	96
13	440.5 ± 0.5
14	$\varnothing 18$
15	$\varnothing 130$
16	$\varnothing 160$
17	135
18	112
19	80
20	80
21	325.5 ± 1
22	44

PC160LC-7E0, PC180LC/NLC-7E0 Hydraulic excavator

Form No. UEN01904-01

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HYDRAULIC EXCAVATOR

PC160LC-7E0**PC180LC-7E0****PC180NLC-7E0**

Machine model	Serial number
---------------	---------------

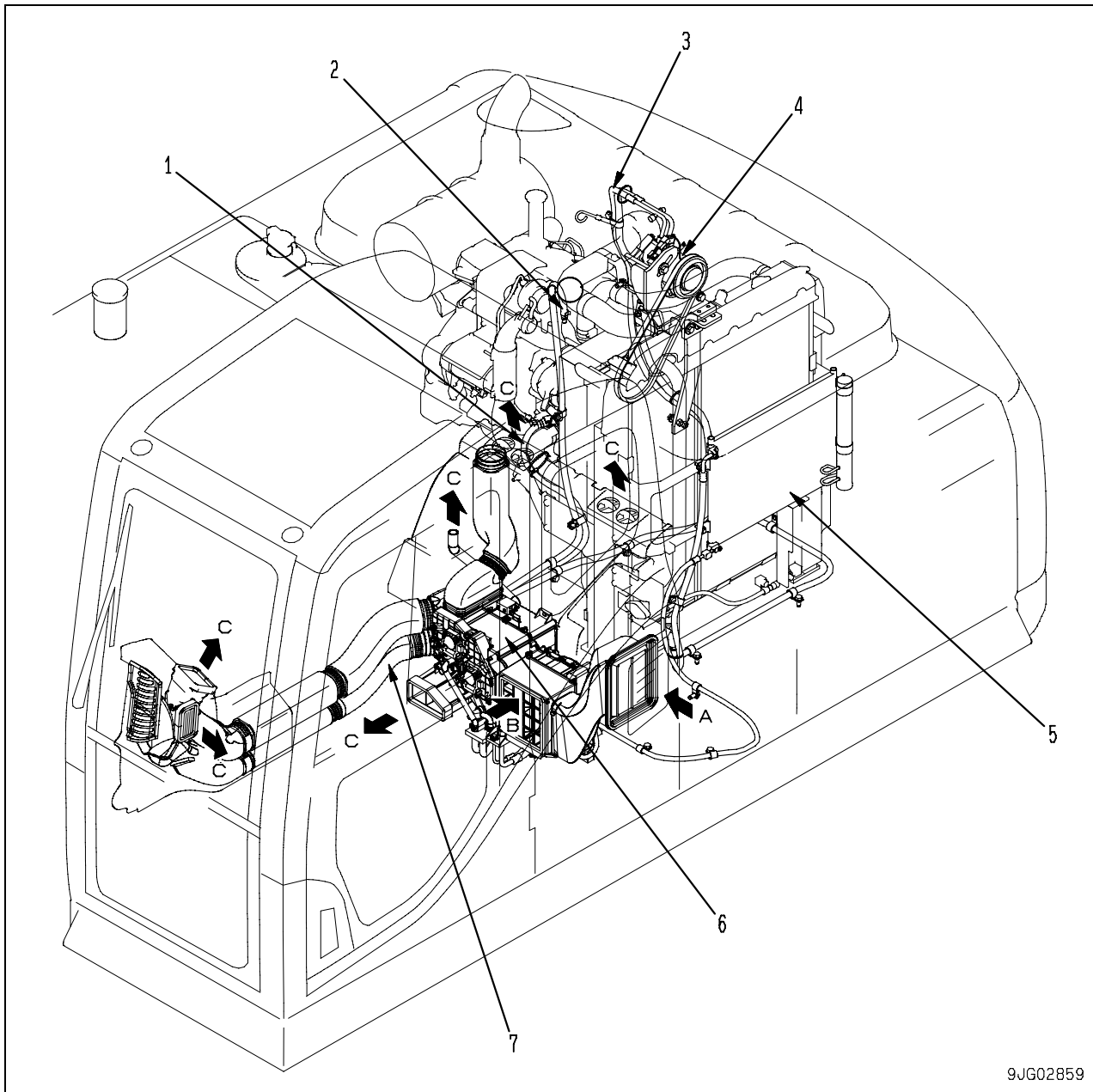
PC160LC-7E0	K45001 and up
PC180LC-7E0	K45001 and up
PC180NLC-7E0	K45001 and up

10 Structure, function and maintenance standard

Cab and its attachments

Air conditioner piping	2
------------------------------	---

Air conditioner piping



9JG02859

1. Hot water return piping
2. Hot water pickup piping
3. Refrigerant piping
4. Air conditioner compressor
5. Condenser
6. Air conditioner unit
7. Duct

- A: Fresh air
B: Recirculated air
C: Hot/cool air

PC160LC-7E0, PC180LC/NLC-7E0 Hydraulic excavator

Form No. UEN01905-00

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HYDRAULIC EXCAVATOR

PC160LC-7E0
PC180LC-7E0
PC180NLC-7E0

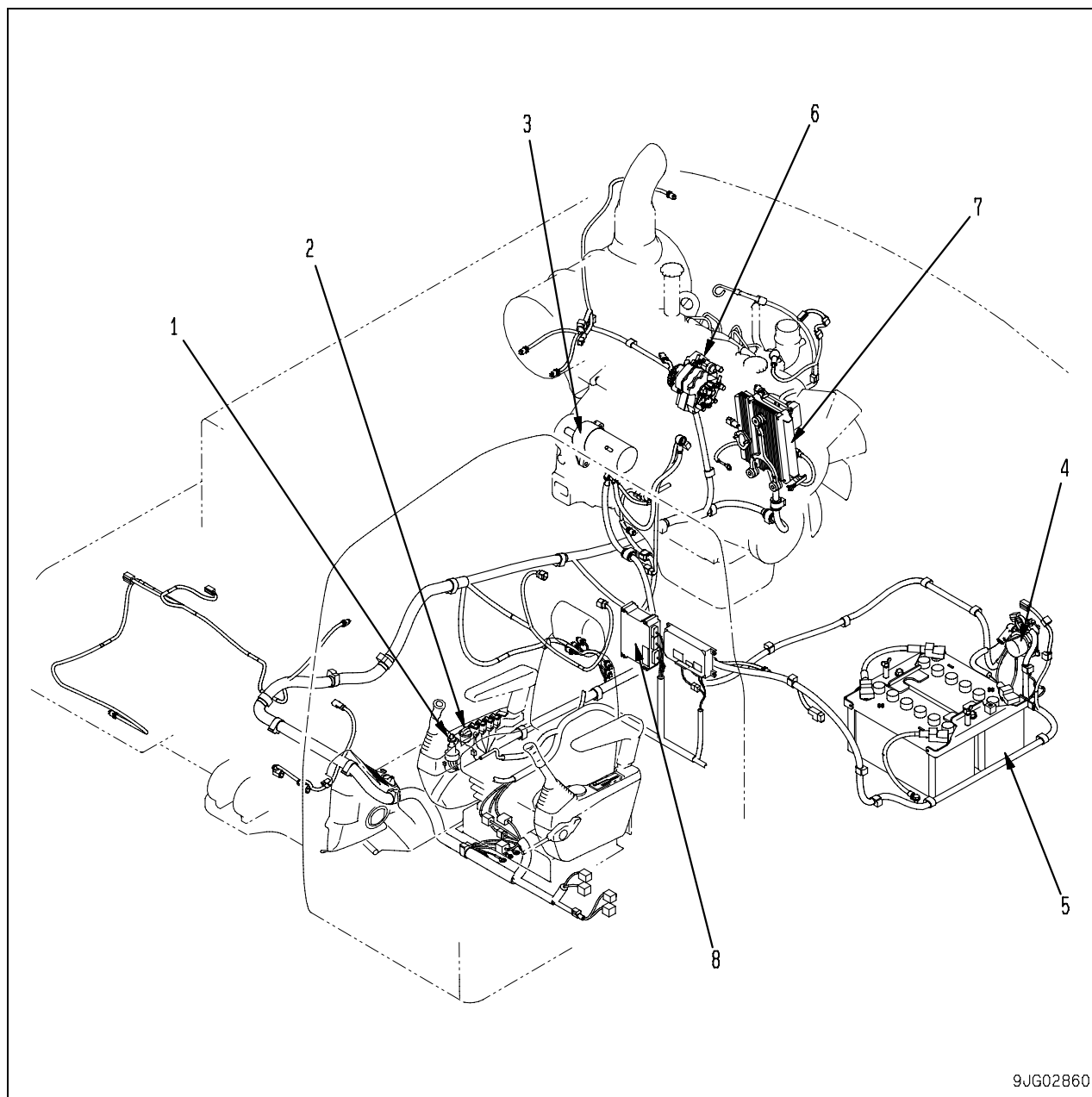
Machine model	Serial number
PC160LC-7E0	K45001 and up
PC180LC-7E0	K45001 and up
PC180NLC-7E0	K45001 and up

10 Structure, function and maintenance standard

Electrical system

Engine control	2
Electronic control system	11
Monitor system	37
Sensor	55
KOMTRAX terminal system	58

Engine control



9JG02860

1. Starting switch
2. Fuel control dial
3. Starting motor
4. Battery relay
5. Battery
6. Supply pump
7. Engine throttle controller
8. Pump controller

Outline

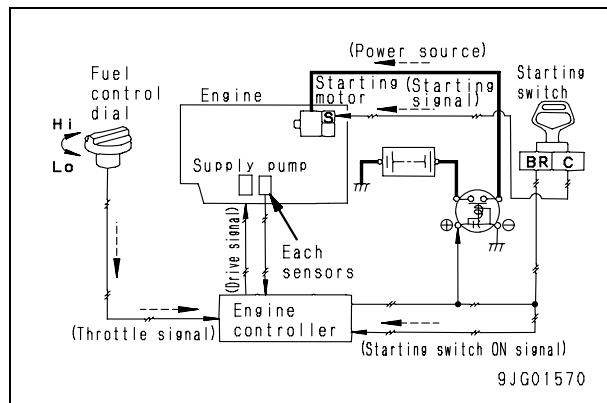
- The engine can be started and stopped simply by using starting switch (1).
- With the dial type engine controller, the control signal from fuel control dial (2) is received by engine throttle controller (7). A drive signal is sent to supply pump (6), and the rack position is controlled to control the engine speed.

Operation of system

Starting engine

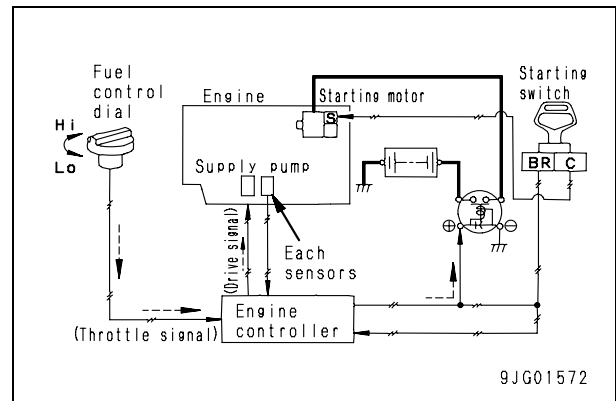
- When the starting switch is turned to the START position, the starting signal flows to the starting motor, and the starting motor turns to start the engine.

When this happens, the engine controller checks the signal from the fuel control dial and sets the engine speed to the speed set by the fuel control dial.



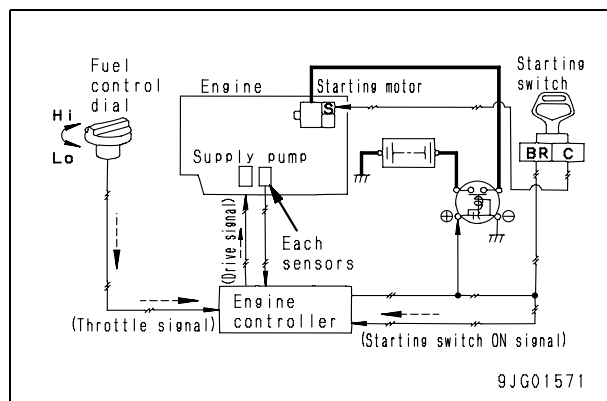
Stopping engine

- When the engine controller detects that the starting switch is at the "STOP" position, it cuts the signal to the supply pump drive solenoid to stop the engine.



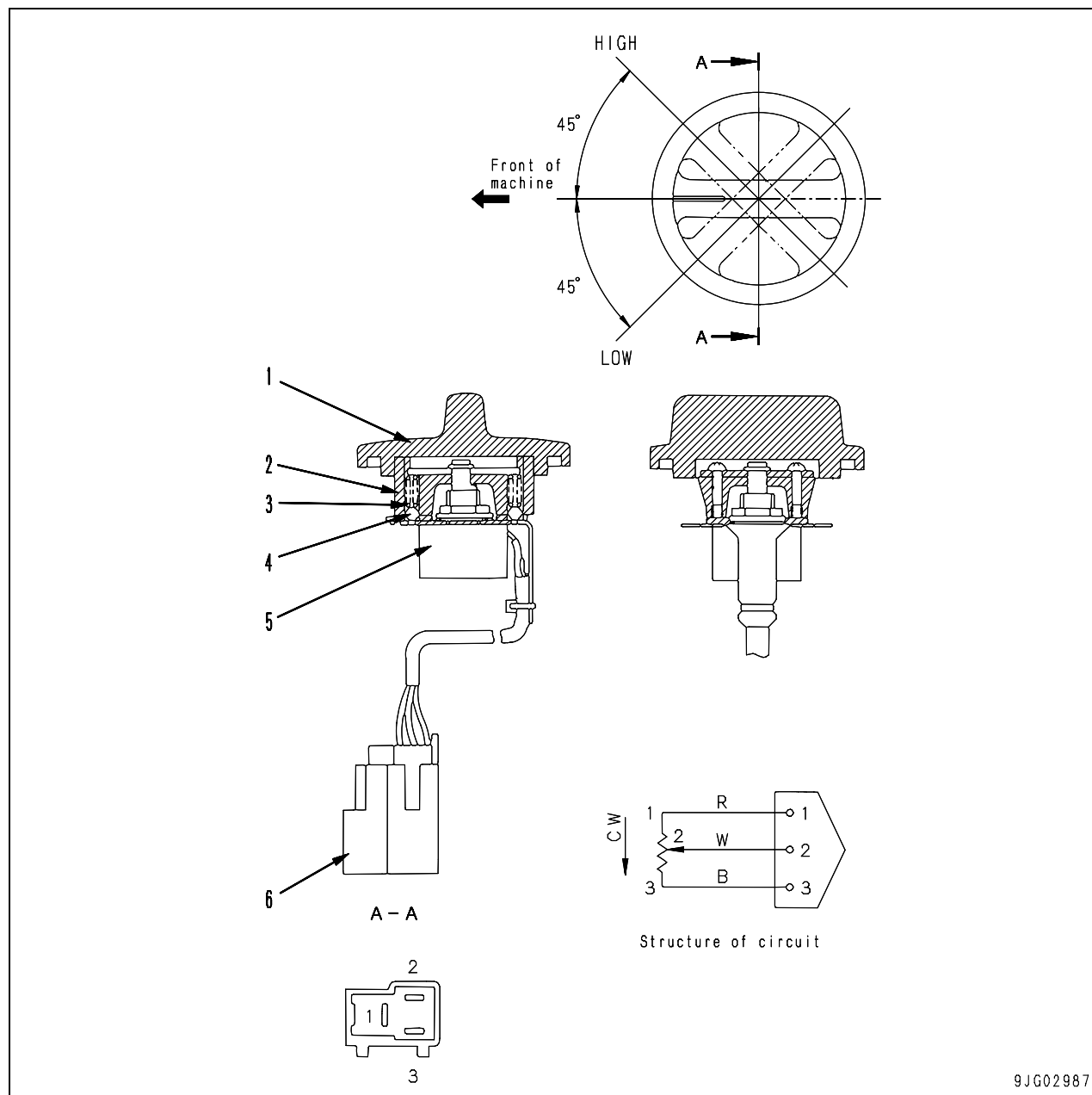
Engine speed control

- The fuel control dial sends signal voltages to the engine controller according to its angle. The engine controller sends drive signals to the supply pump according to the signal voltages received from the fuel control dial and controls the fuel injection pump to control the engine speed.



Component

Fuel control dial

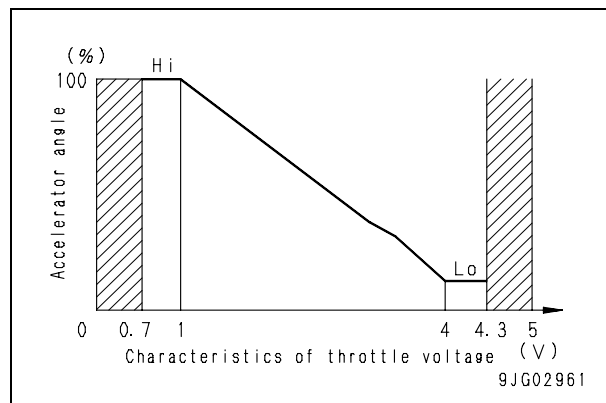


1. Knob
2. Dial
3. Spring

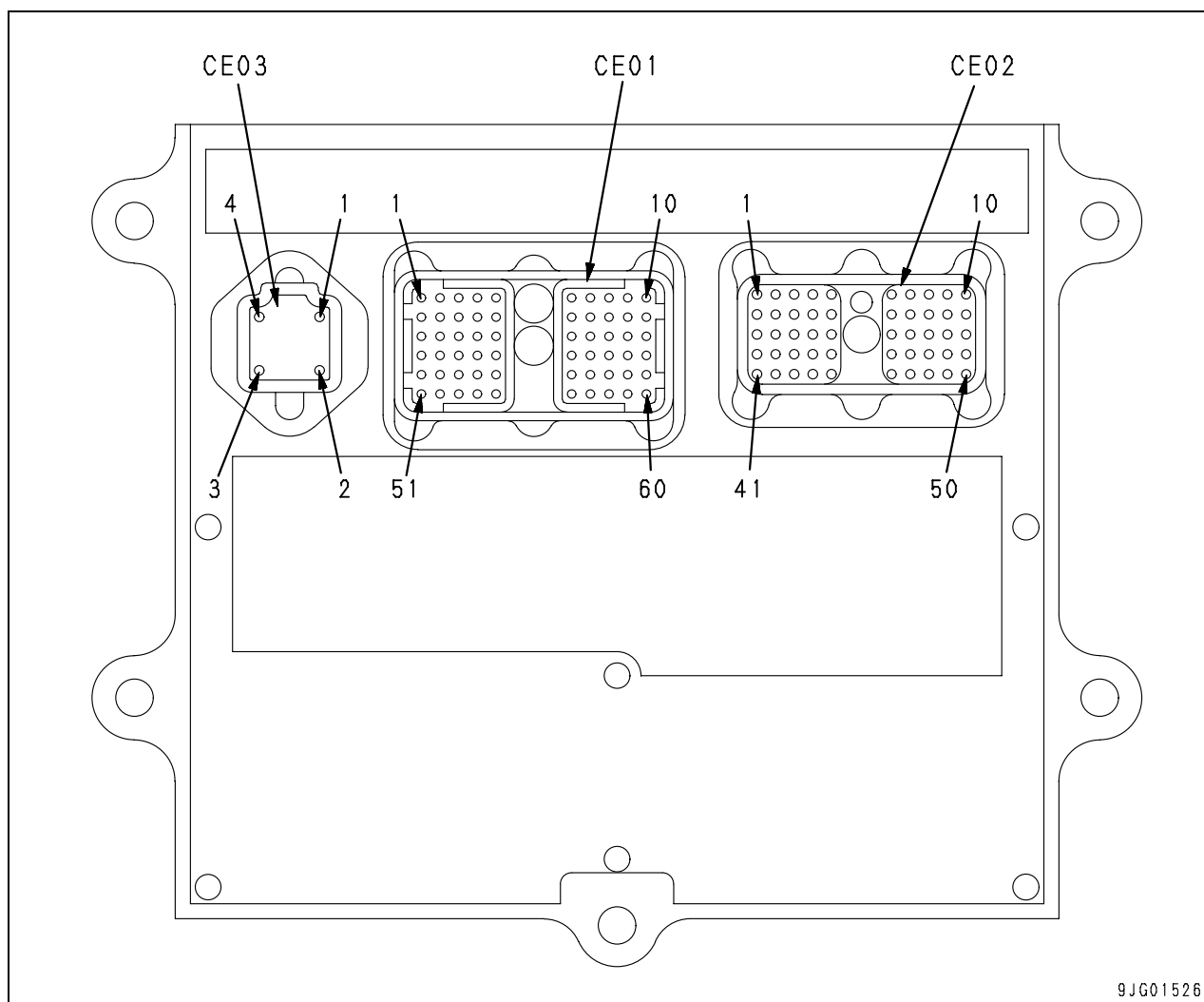
4. Ball
5. Potentiometer
6. Connector

Function

- The fuel control dial is installed at the bottom of the machine monitor. A potentiometer is installed under the knob, and when the knob is turned, it rotates the potentiometer shaft. When the shaft rotates, the resistance of the variable resistor inside the potentiometer changes, and the desired throttle signal is sent to the engine throttle controller. The hatched area in the graph below is the abnormality detection area and the engine speed is set at low idle.



Engine controller



9JG01526

- Meanings of signal classes in the terminal table shown below are as follows.

A: Power Supply

B: Input

C: Ground/Shield/Return

D: Output

E: Communication

CN-CE01

Pin No.	Signal name	Input/output
1	NC(*)	—
2	Electric power supply for IMA	D
3	Atmosphere sensor	B
4	NC(*)	—
5	NC(*)	—
6	CAN(—)	E
7	NC(*)	—
8	CAN(+)	E
9	NC(*)	—
10	NC(*)	—

*: Never connect to NC or malfunctions or failures will occur.

CN-CE01

Pin No.	Signal name	Input/output
11	NC(*)	—
12	NC(*)	—
13	NC(*)	—
14	WATER-IN-FUEL sensor	B
15	Coolant temperature sensor	B
16	5V electric power supply for sensor	A
17	Oil pressure switch	B
18	NC(*)	—
19	NC(*)	—
20	NC(*)	—
21	NC(*)	—
22	NC(*)	—
23	Boost temperature sensor	B
24	NC(*)	—
25	Common rail pressure sensor	B
26	Backup sensor	B
27	NE sensor (+)	B

*: Never connect to NC or malfunctions or failures will occur.

CN-CE01

Pin No.	Signal name	Input/output
28	NC(*)	—
29	NC(*)	—
30	NC(*)	—
31	NC(*)	—
32	IMA return	C
33	5 V electric power supply for sensor	A
34	NC(*)	—
35	NC(*)	—
36	NC(*)	—
37	5 V electric power supply for sensor	A
38	GND	C
39	NC(*)	—
40	NC(*)	—
41	NC(*)	—
42	NC(*)	—
43	NC(*)	—
44	Boost pressure sensor	B
45	Injector #1 (+)	D
46	Injector #3 (+)	D
47	Backup sensor	C
48	Ne sensor (—)	C
49	NC(*)	—
50	NC(*)	—
51	NC(*)	—
52	Injector #4 (—)	C
53	Injector #1 (—)	C
54	NC(*)	—
55	Injector #4 (+)	D
56	NC(*)	—
57	Injector #2 (+)	D
58	NC(*)	—
59	Injector #2 (—)	C
60	Injector #3 (—)	C

*: Never connect to NC or malfunctions or failures will occur.

CN-CE02

Pin No.	Signal name	Input/output
1	NC(*)	—
2	NC(*)	—
3	NC(*)	—
4	NC(*)	—
5	NC(*)	—
6	NC(*)	—
7	NC(*)	—
8	NC(*)	—
9	Fuel control dial (+)	B
10	NC(*)	—
11	NC(*)	—
12	NC(*)	—

*: Never connect to NC or malfunctions or failures will occur.

CN-CE02

Pin No.	Signal name	Input/output
13	NC(*)	—
14	NC(*)	—
15	NC(*)	—
16	NC(*)	—
17	NC(*)	—
18	NC(*)	—
19	NC(*)	—
20	NC(*)	—
21	NC(*)	—
22	Fuel control dial (+5V)	A
23	Fuel control dial (—)	C
24	NC(*)	—
25	NC(*)	—
26	NC(*)	—
27	NC(*)	—
28	NC(*)	—
29	NC(*)	—
30	NC(*)	—
31	NC(*)	—
32	NC(*)	—
33	GND	C
34	NC(*)	—
35	NC(*)	—
36	NC(*)	—
37	NC(*)	—
38	NC(*)	—
39	Key switch (ACC)	A
40	Electrical intake air heater relay drive	D
41	NC(*)	—
42	Electrical intake air heater relay return	C
43	NC(*)	—
44	NC(*)	—
45	NC(*)	—
46	CAN(+)	E
47	CAN(—)	E
48	NC(*)	—
49	PWM OUTPUT	D
50	NC(*)	—

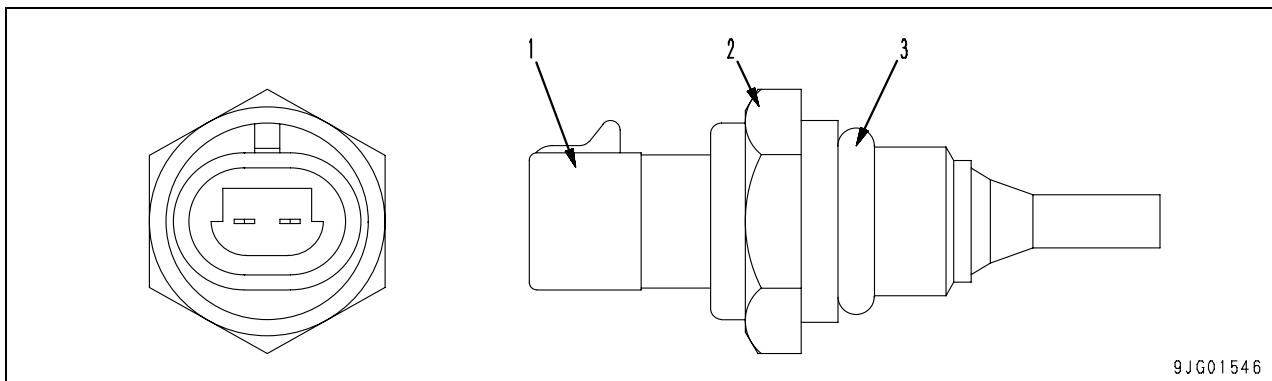
*: Never connect to NC or malfunctions or failures will occur.

CN-CE03

Pin No.	Signal name	Input/output
1	GND	C
2	NC(*)	—
3	Electric power supply (+24V constantly)	A
4	NC(*)	—

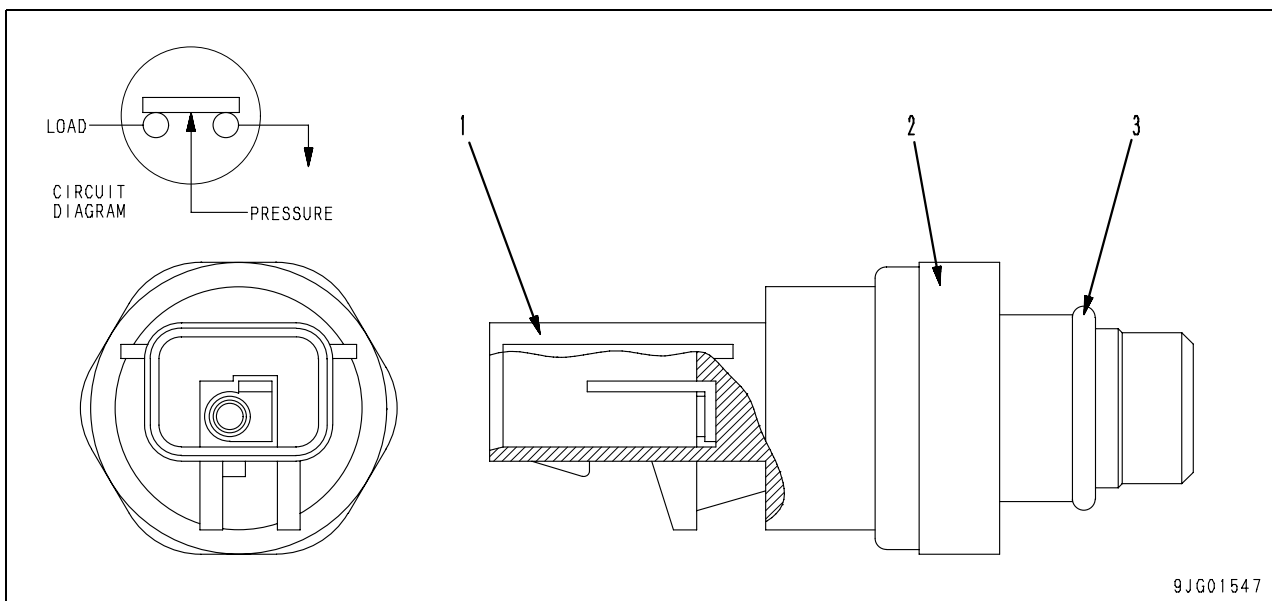
*: Never connect to NC or malfunctions or failures will occur.

Coolant temperature sensor



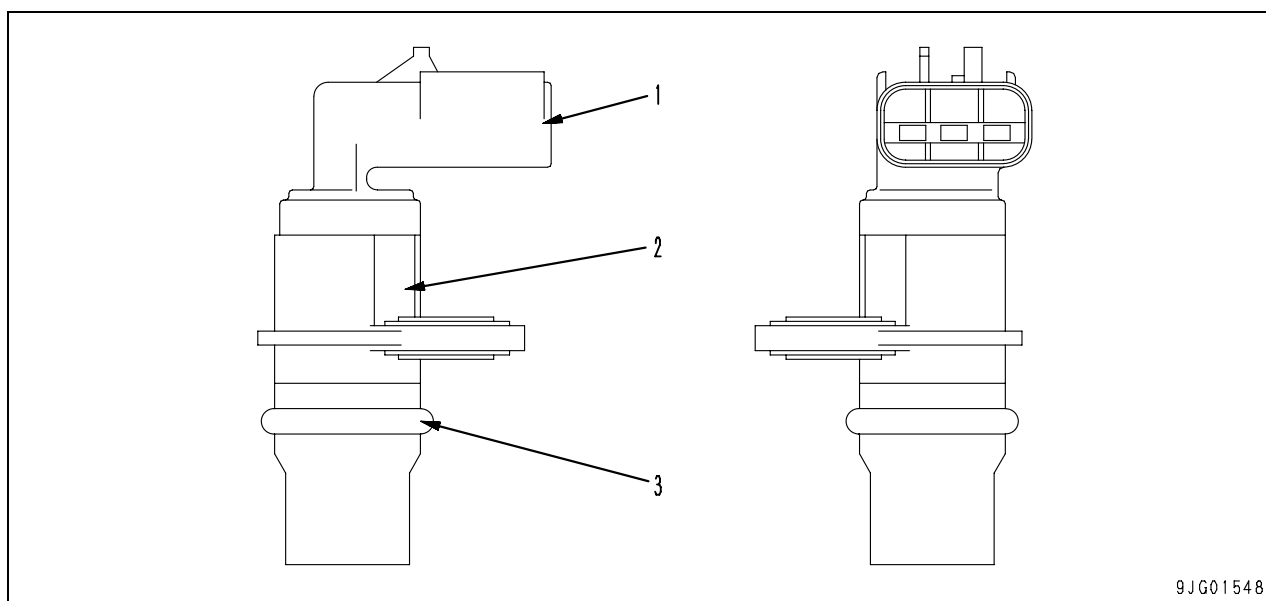
1. Connector
2. Sensor
3. O-ring

Oil pressure switch



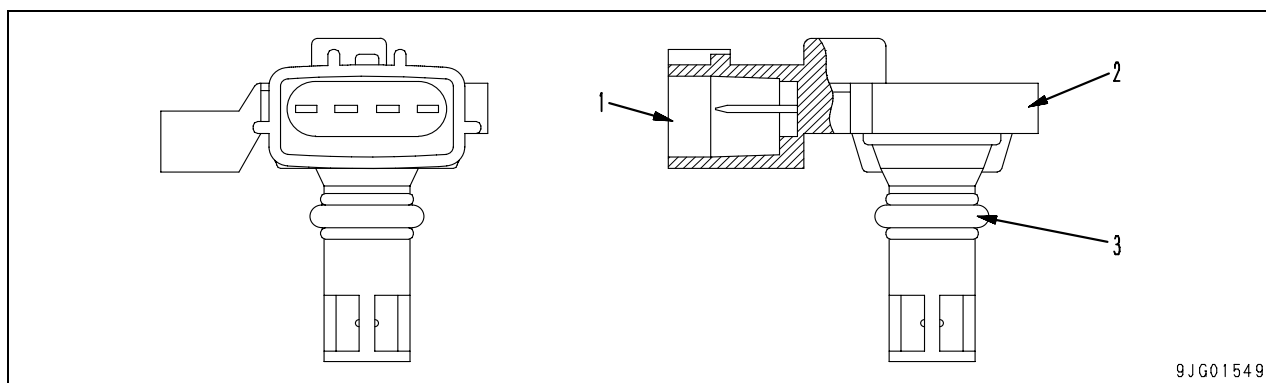
1. Connector
2. Sensor
3. O-ring

Rotation sensor

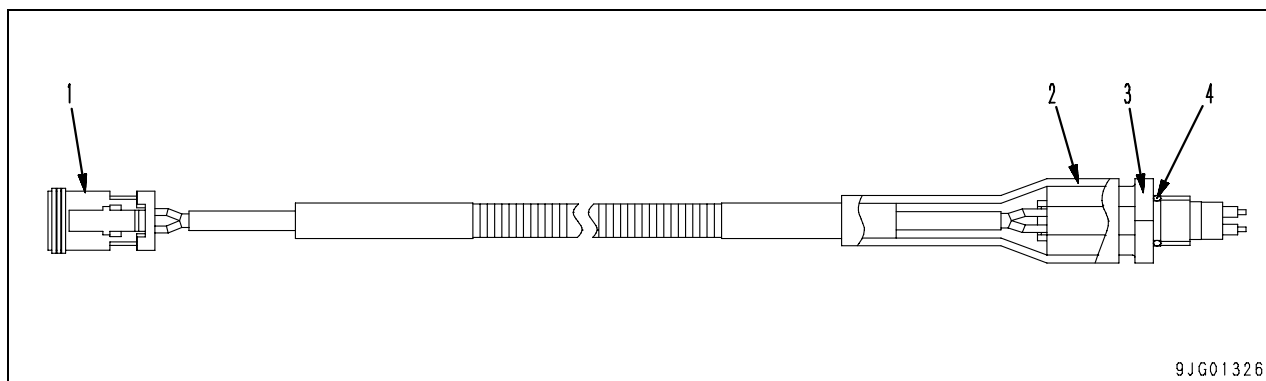


1. Connector
2. Sensor
3. O-ring

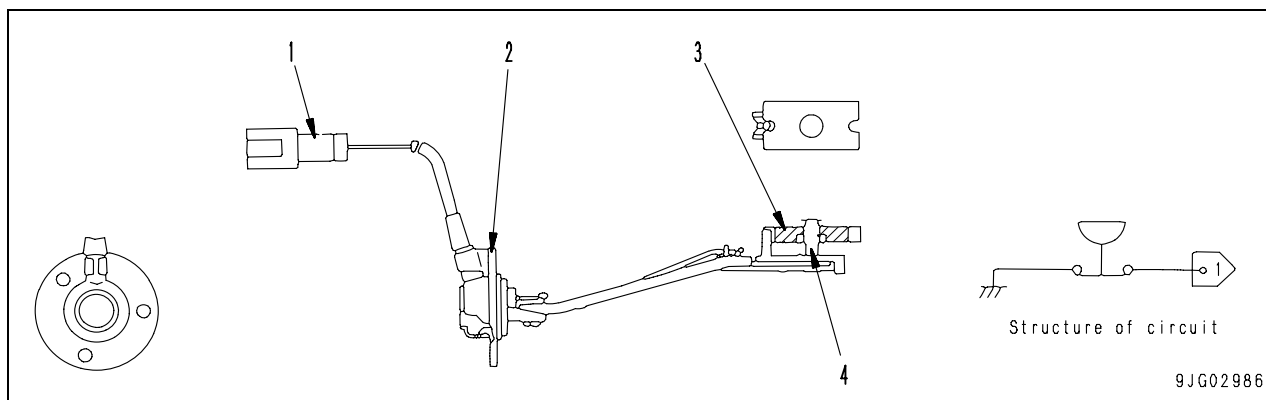
Boost pressure and temperature sensor



1. Connector
2. Sensor
3. O-ring

WIF (water-in-fuel detection) sensor

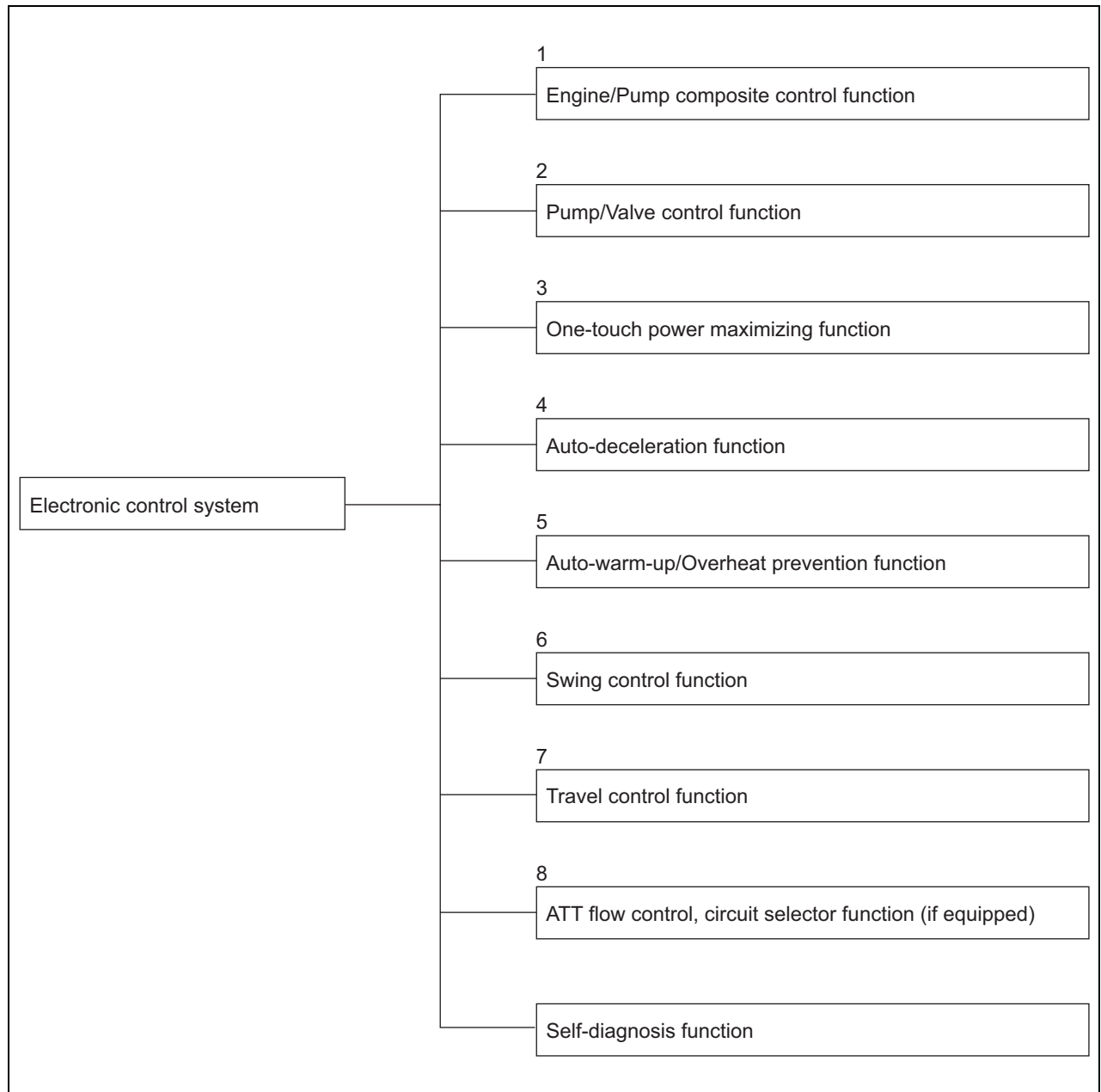
1. Connector
2. Tube
3. Sensor
4. O-ring

Engine oil level sensor

1. Connector
2. Bracket
3. Float
4. Switch

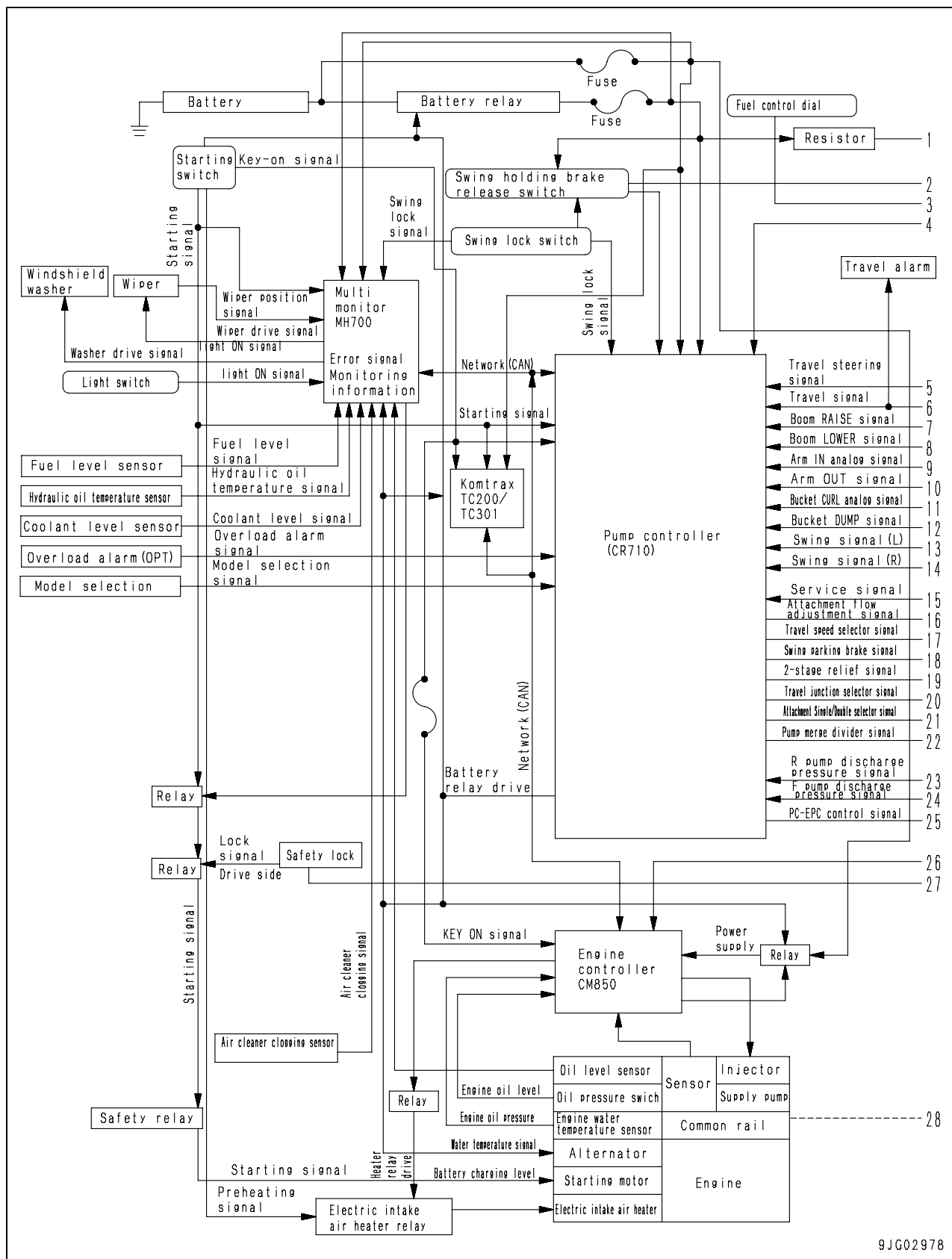
Electronic control system

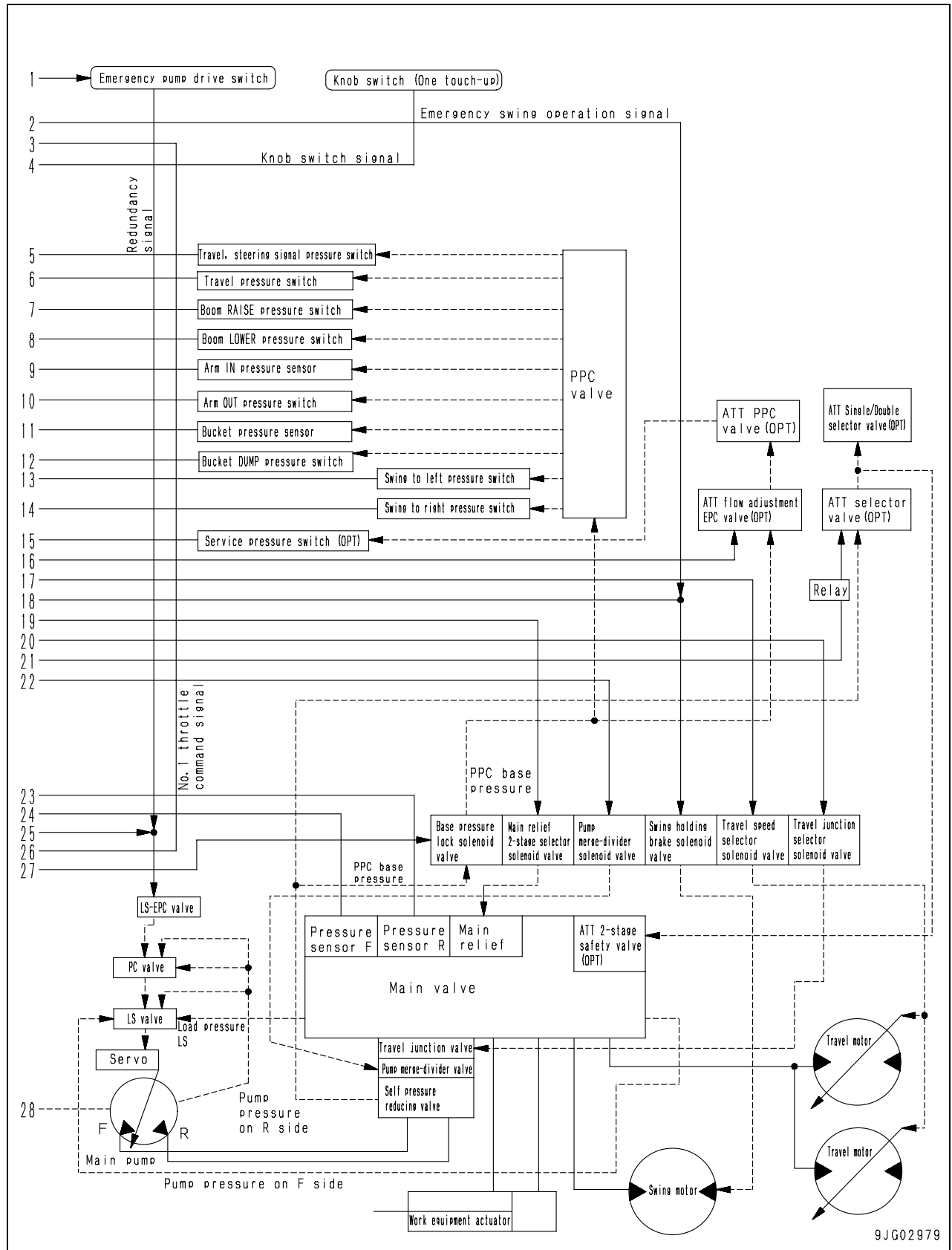
Control function



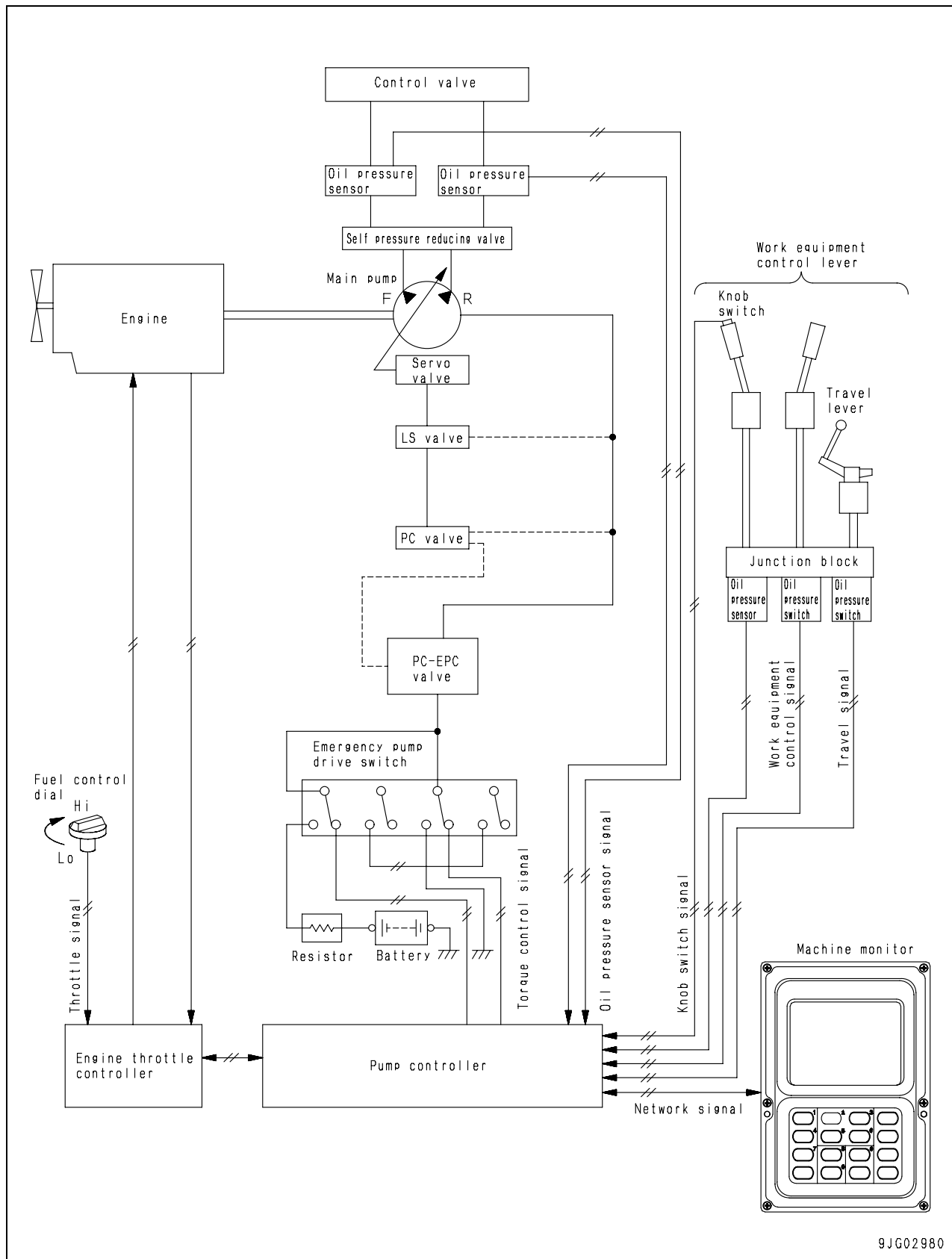
★ For the self-diagnosis function, see "Trouble shooting".

Machine control system diagram



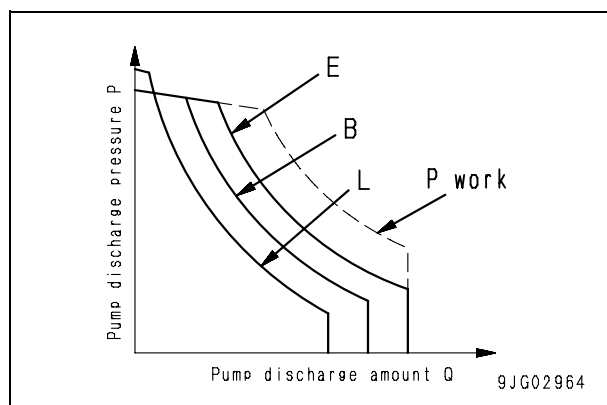
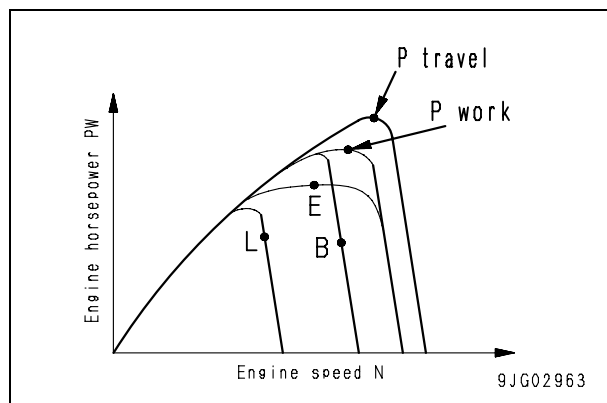
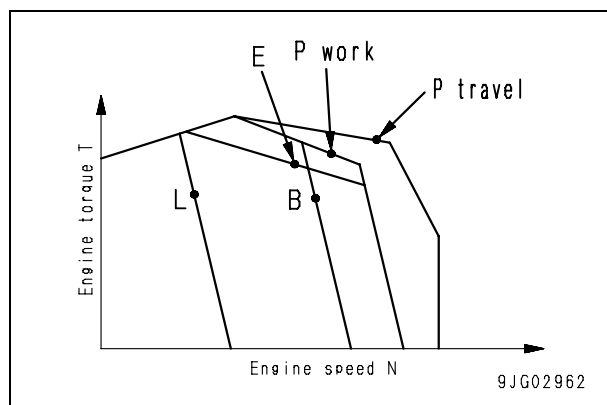


Engine and pump composite control function



Function

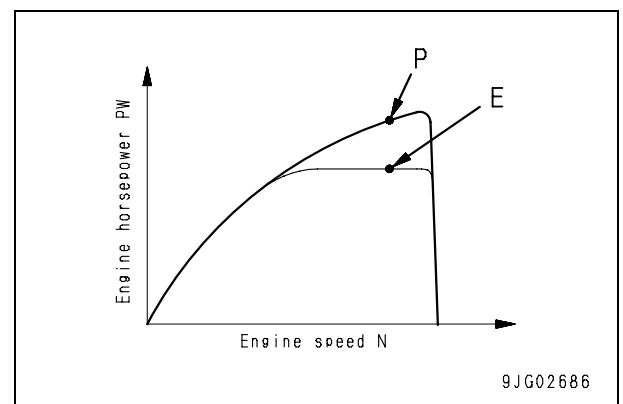
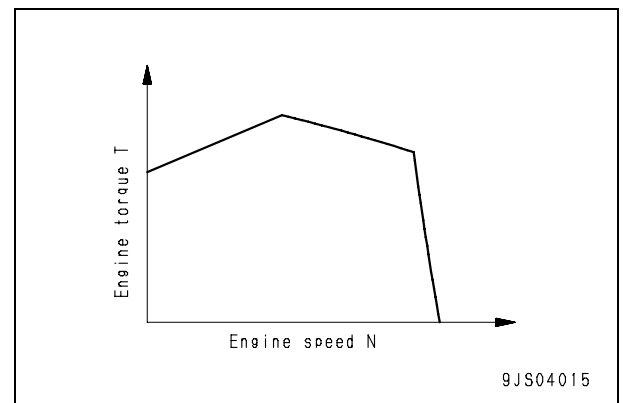
- This function allows the operator to select engine torque (T) and pump absorption torque depending on the work contents of the machine.
Four modes of P, E, L and B are specified as working modes.
To select a working mode, use the working mode selector switch of the machine monitor.
- The pump controller controls the pump so that it can absorb all the torque at the output points of the engine depending on the pump absorption torque specified for each mode, rotation set by the fuel control dial, and actual engine speed.

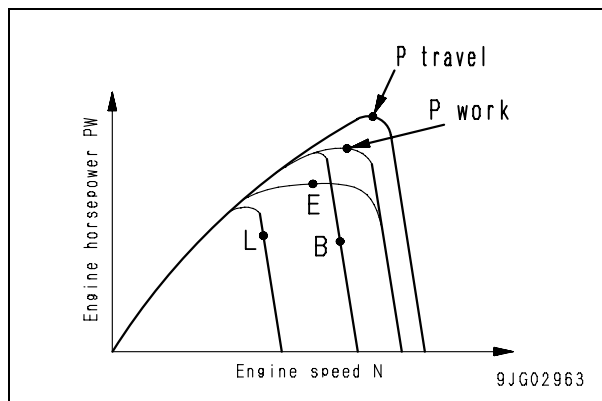
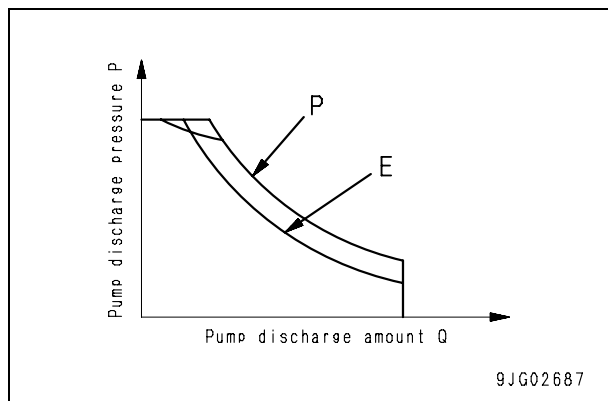
**1) Control method in each mode****P mode and E mode**

- Matching point

Mode	Matching point
Travel P	84.5 kW/2,150 rpm {115 HP/2,150 rpm}
Work P	76.5 kW/1,974 rpm {103 HP/1,974 rpm}
E	65.5 kW/1,817 rpm {88 HP/1,817 rpm}

- In P and E mode, engine speed is always controlled so that it is kept around the matching point specified for each mode.
- If the pump load increases and the pressure rises, engine speed (N) lowers. If it happens, the engine speed is increased to around the matching point, allowing the pump controller to decrease pump delivery (Q). On the contrary, the pump load decreases and the pressure lowers, the pump controller continues to increase pump delivery until the engine speed reaches around the matching point.



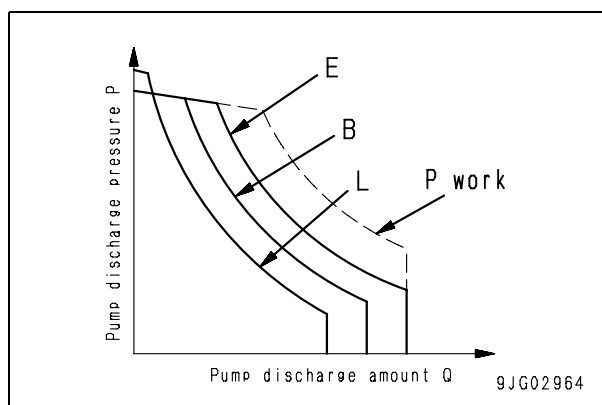
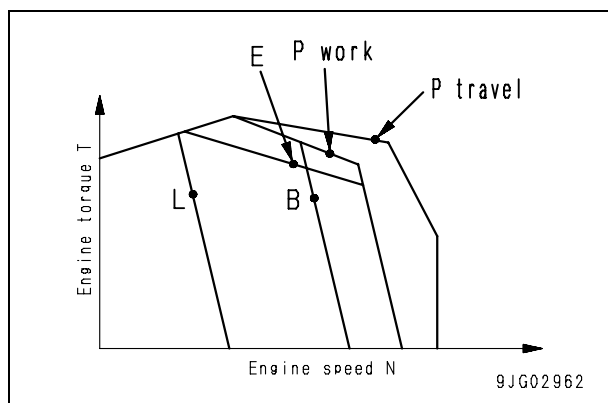


B mode and L mode

Mode	B	L
Partial output point	79%	68%

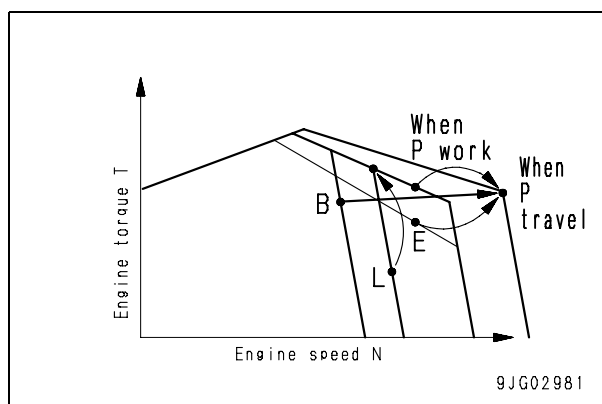
Mode	Matching point
B	60.3 kW/1,840 rpm {81 HP/1,840 rpm}
L	52.2 kW/1,536 rpm {70 HP/1,536 rpm}

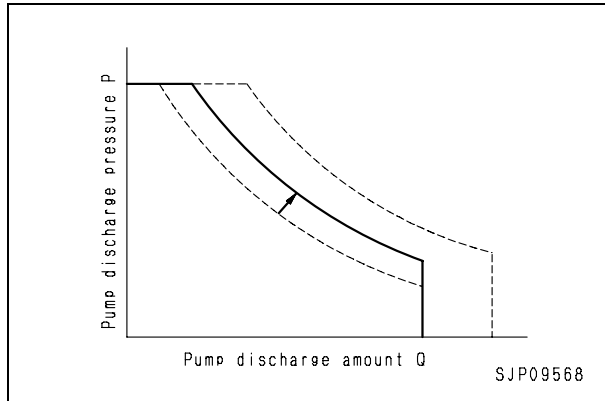
- In B or L mode, engine output is controlled to a constant level.
- The controller controls the pump absorption torque to decrease the engine speed while keeping the engine torque at a constant level along the equal engine horsepower curve.
- The controller controls pump delivery (Q) so that the engine torque can be kept at a constant level along the equal engine horsepower curve.



2) Function to control pump during travel

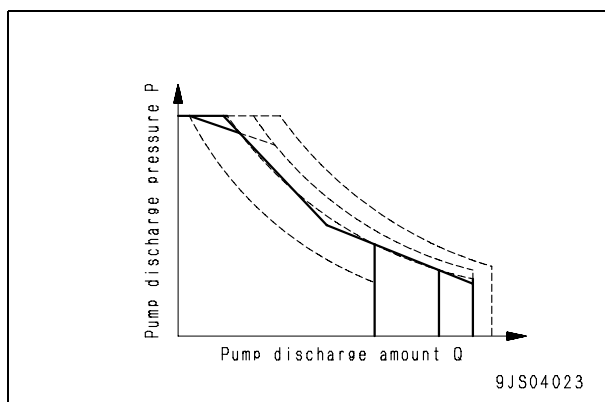
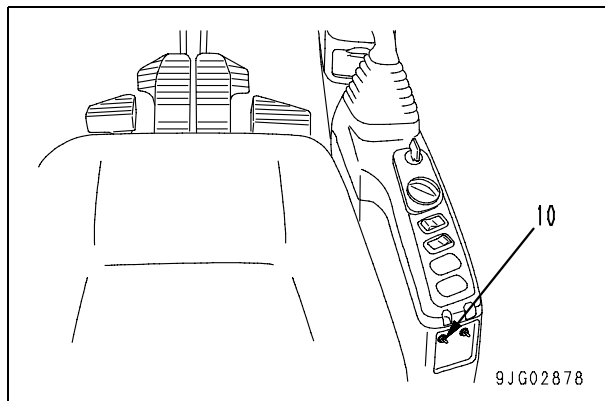
- Travelling the machine in P mode increases engine speed (N).
- Travelling the machine in E or B mode leaves the working mode unchanged, but raises the pump absorption torque and engine speed (N) to values same as those in P mode.
- If the machine travels in L mode, the working mode and engine speed (N) do not change, but the pump absorption torque is increased.



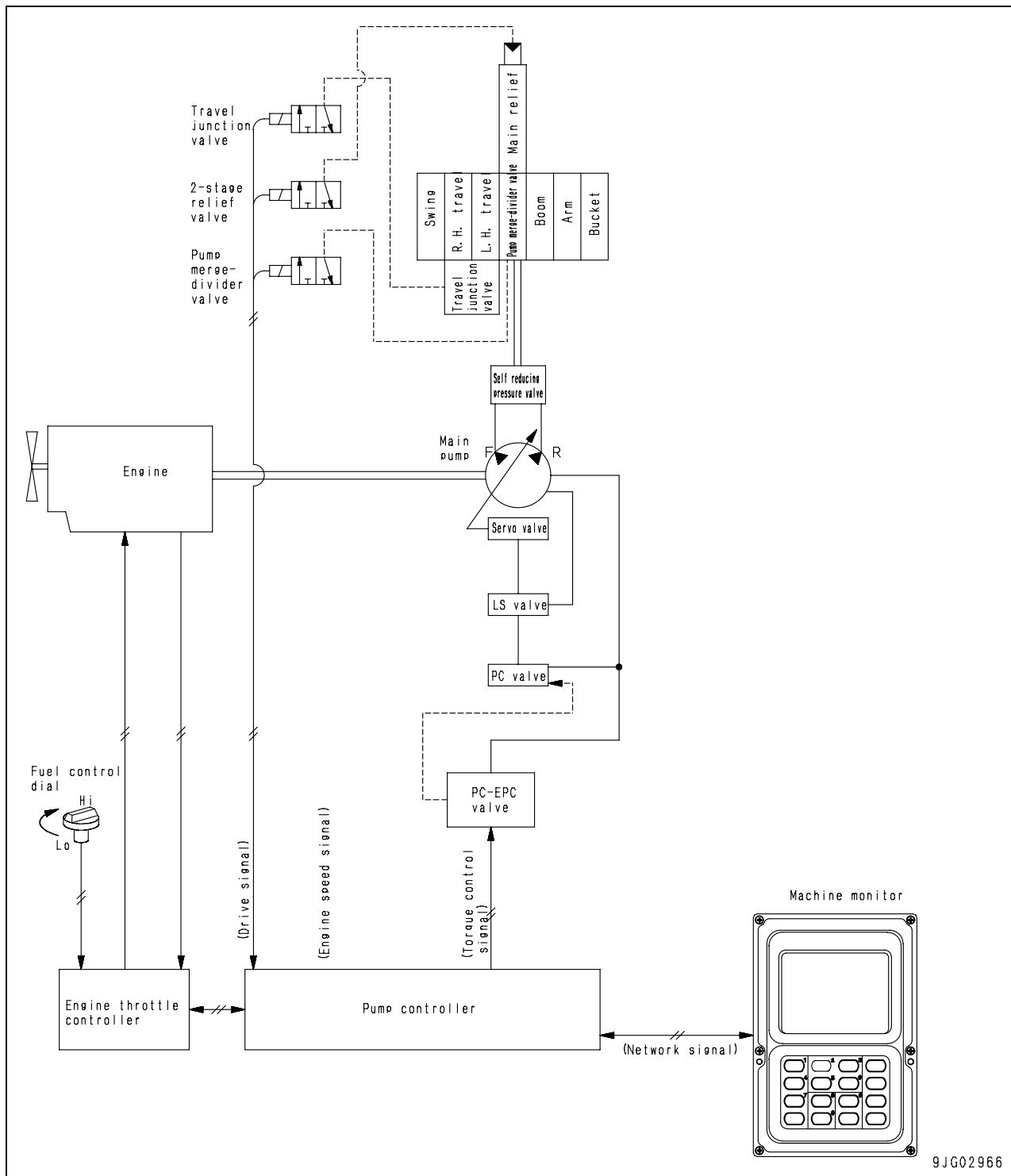


3) Function to control when emergency pump drive switch is turned on

- Even if any abnormality occurs in the controller or sensor, setting emergency pump drive switch (10) to the "ON" position activates the machine with an absorption torque approximately equivalent to that in E mode. In this case, a constant current flows from the battery to the EPC valve for PC and therefore, the oil pressure is sensed by only the EPC valve for PC.



Pump and valve control function

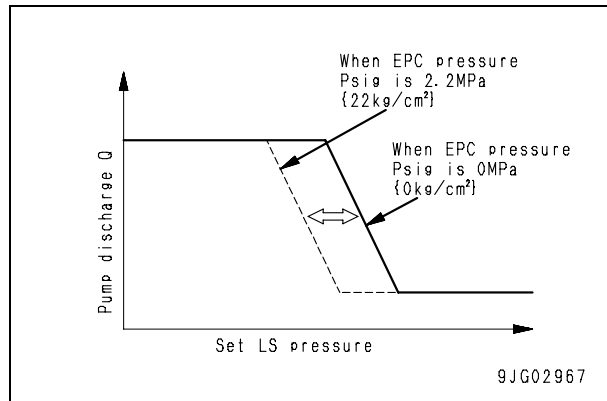


Function

- The machine is matched to various types of work properly with the 2-stage relief function to increase the digging force, etc.

1) LS control function

- Depending on the operation condition of the actuator, this function changes the pressure output from the LS-EPC valve to LS valve to change the change point (LS set differential pressure (DLS)) of the pump discharge in the LS valve.
- By this operation, the start-up time of the pump discharge is optimized and the composite operation and fine control performance is improved.

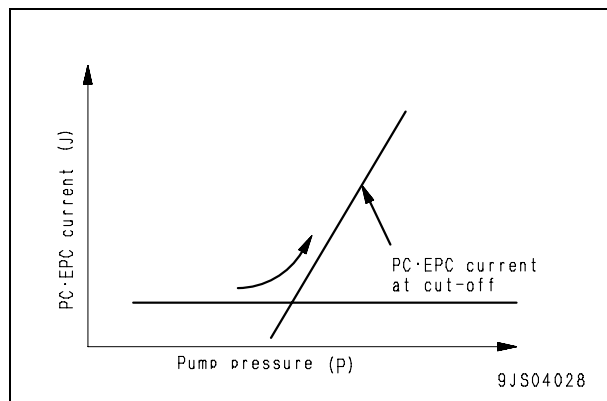
**2) Cut-off function**

- This function increases PC-EPC current (J) to reduce the flow rate in the relief state, improving fuel consumption.

Operating condition for turning on cut-off function

When the average value of the front and rear pressure sensors is above 27.9 MPa {285 kg/cm ² } with the power maximizing function off.

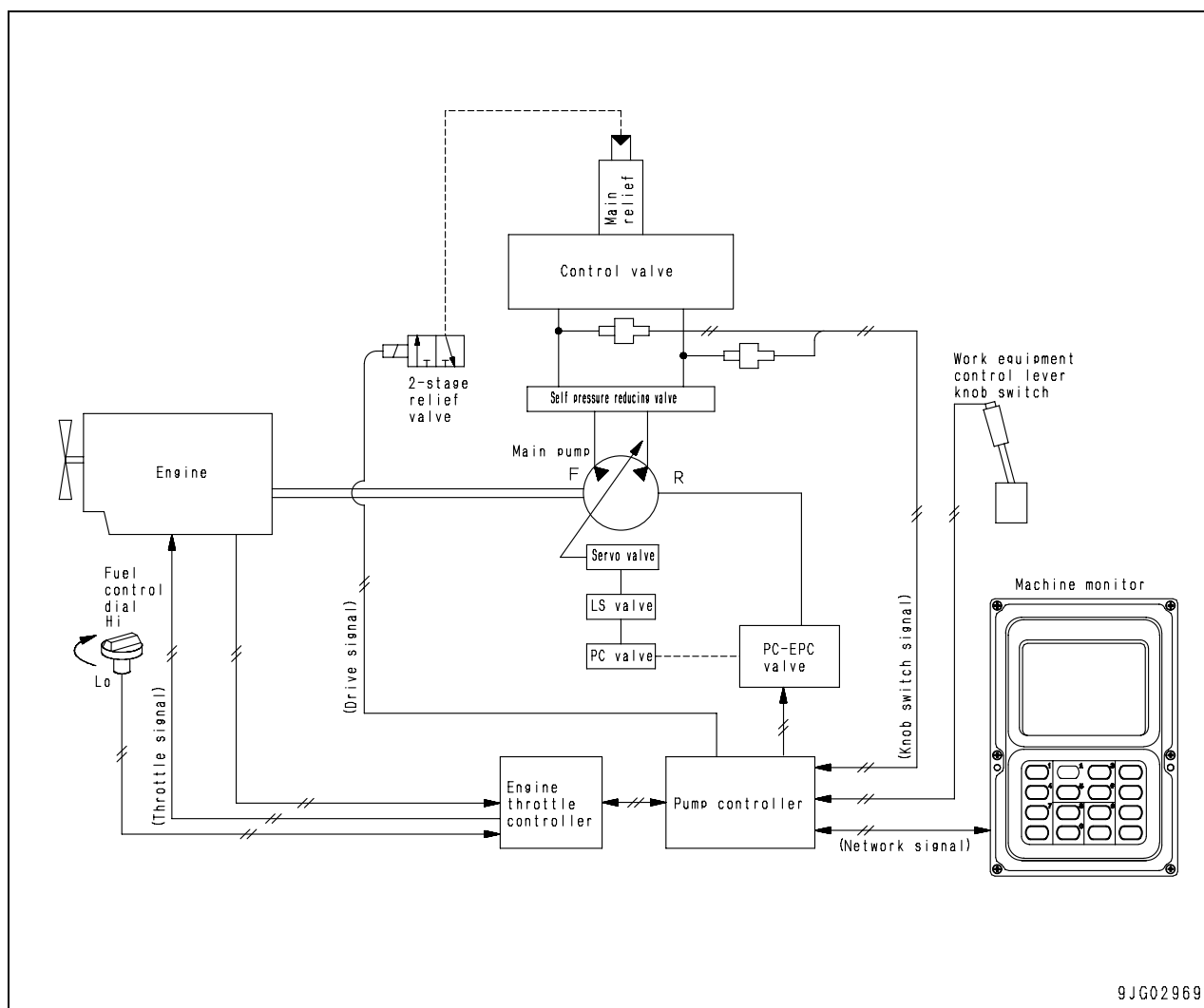
The cut-off function does not work, however, while the machine is travelling in P mode, swing lock switch is in the "ON" position.
--

**3) 2-stage relief function**

- The relief pressure in the normal work is 34.8 MPa {355 kg/cm²}. If the 2-stage relief function is turned on, however, the relief pressure rises to about 37.2 MPa {380 kg/cm²}. By this operation, the hydraulic force is increased further.

Operating condition for turning on 2-stage relief function	Relief pressure
<ul style="list-style-type: none"> During travel When swing lock switch is turned to the ON position When boom is lowered When power maximizing function is turned on When L mode is operated 	34.8 MPa {355 kg/cm ² } ↓ 37.2 MPa {380 kg/cm ² }

Power maximizing function



Function

- The power maximizing function allows the operator to increase power for a certain time by operating the left knob switch.

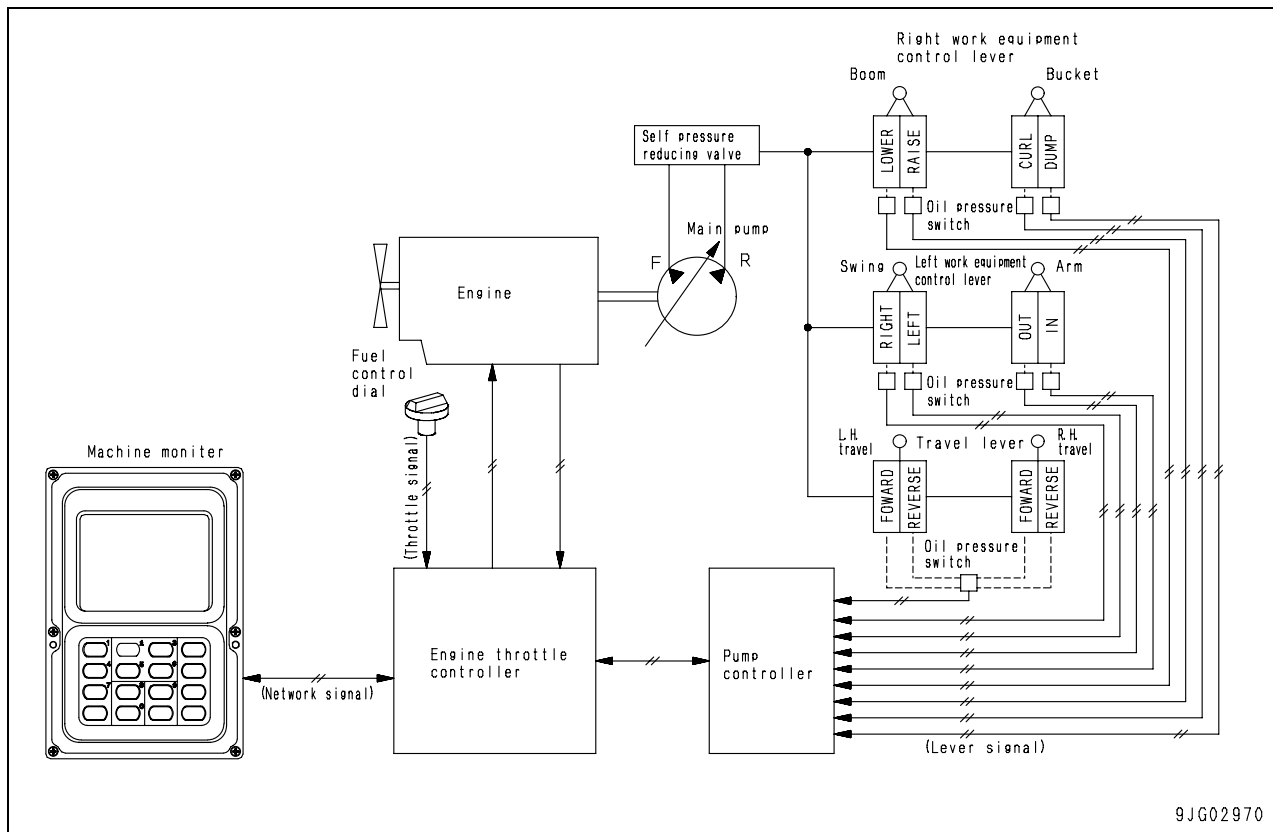
1) Power maximizing function

- This function is used to increase digging force for a certain period of time (e.g., when digging up a large rock).
- If the left knob switch is pressed in P or E mode, the hydraulic force is increased about 7% to increase the digging force. Each function is set automatically as shown below.

Function	Setting	
	P mode	E mode
Engine and pump control	Matching point 103 HP/1,974rpm ↓ 113 HP/2,145rpm	Matching at rated output point
2-stage relief function	34.8 MPa {355 kg/cm ² } ↓ 37.2 MPa {380 kg/cm ² }	
Software cut-off function	Cancel	

- These settings are automatically reset after 8.5 seconds when the switch is pressed.

Auto-deceleration function



Function

- The auto-deceleration function automatically reduces the engine speed to its medium speed range when the all control levers are set in NEUTRAL while waiting for a dump truck or work to reduce the fuel consumption and noise.
- If any lever is operated, the engine speed instantly returns to the speed set with the fuel control dial.

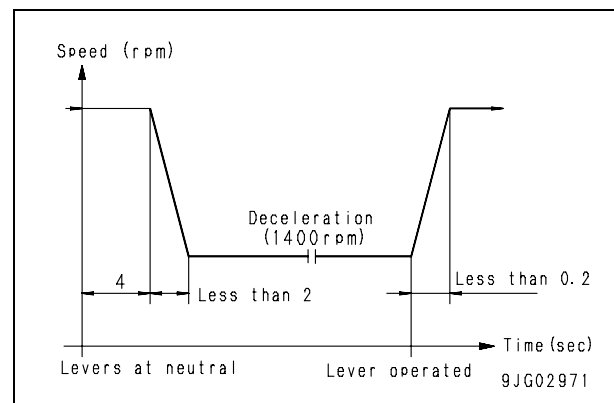
Operation

When control levers are set in neutral

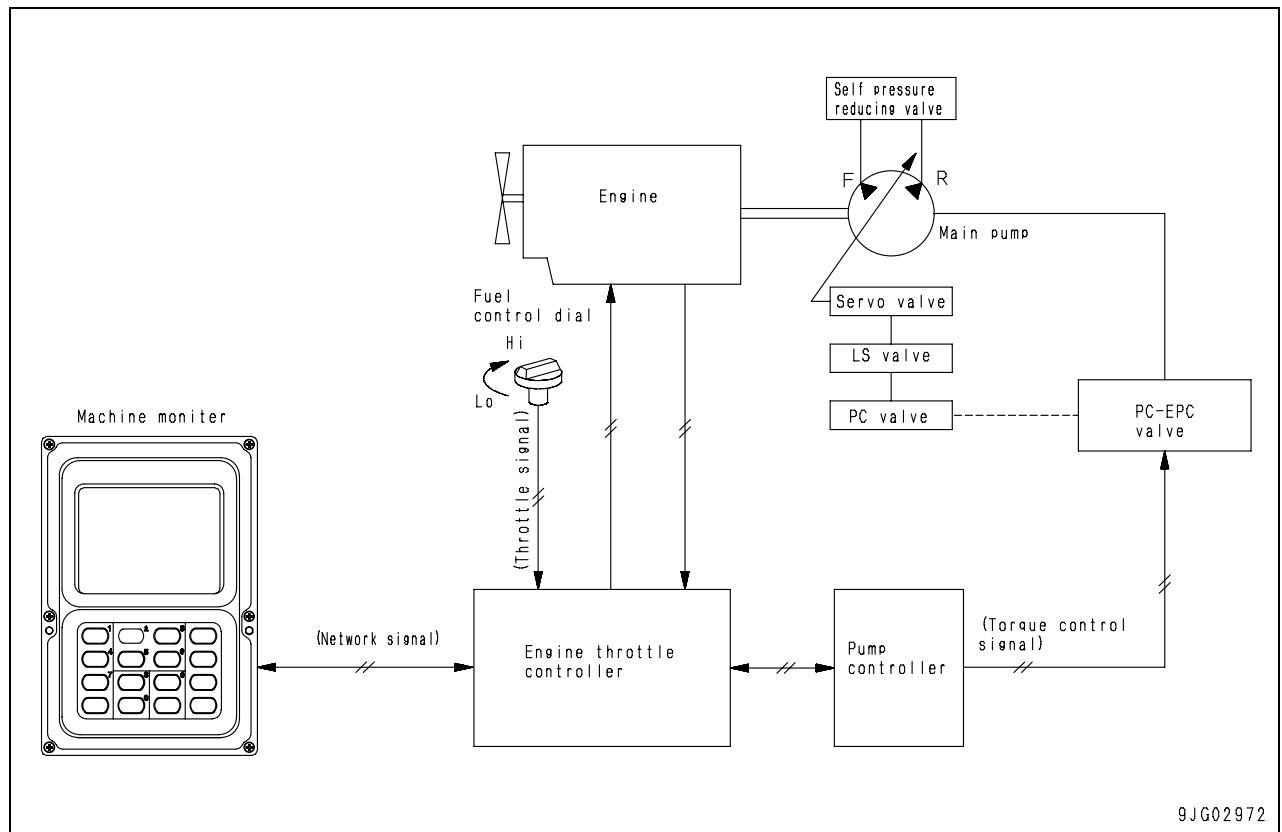
- If all the control levers are kept to NEUTRAL for 4 sec. during operation at a engine speed above a decelerator operation level (approximately 1,400 rpm), this function lowers the engine speed to the deceleration operation level (approximately 1,400 rpm) and keeps it until you operate any lever.

When any control lever is operated

- If you operate any control lever while the engine speed is kept at the deceleration operation level, the engine speed instantly rises to the level set with the fuel control dial.



Auto-warm-up and overheat prevention function

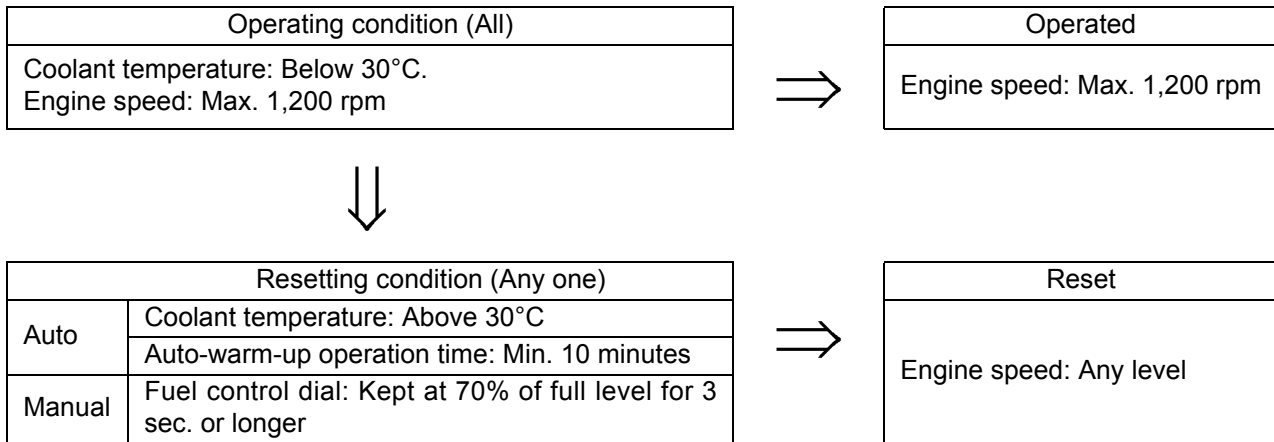


Function

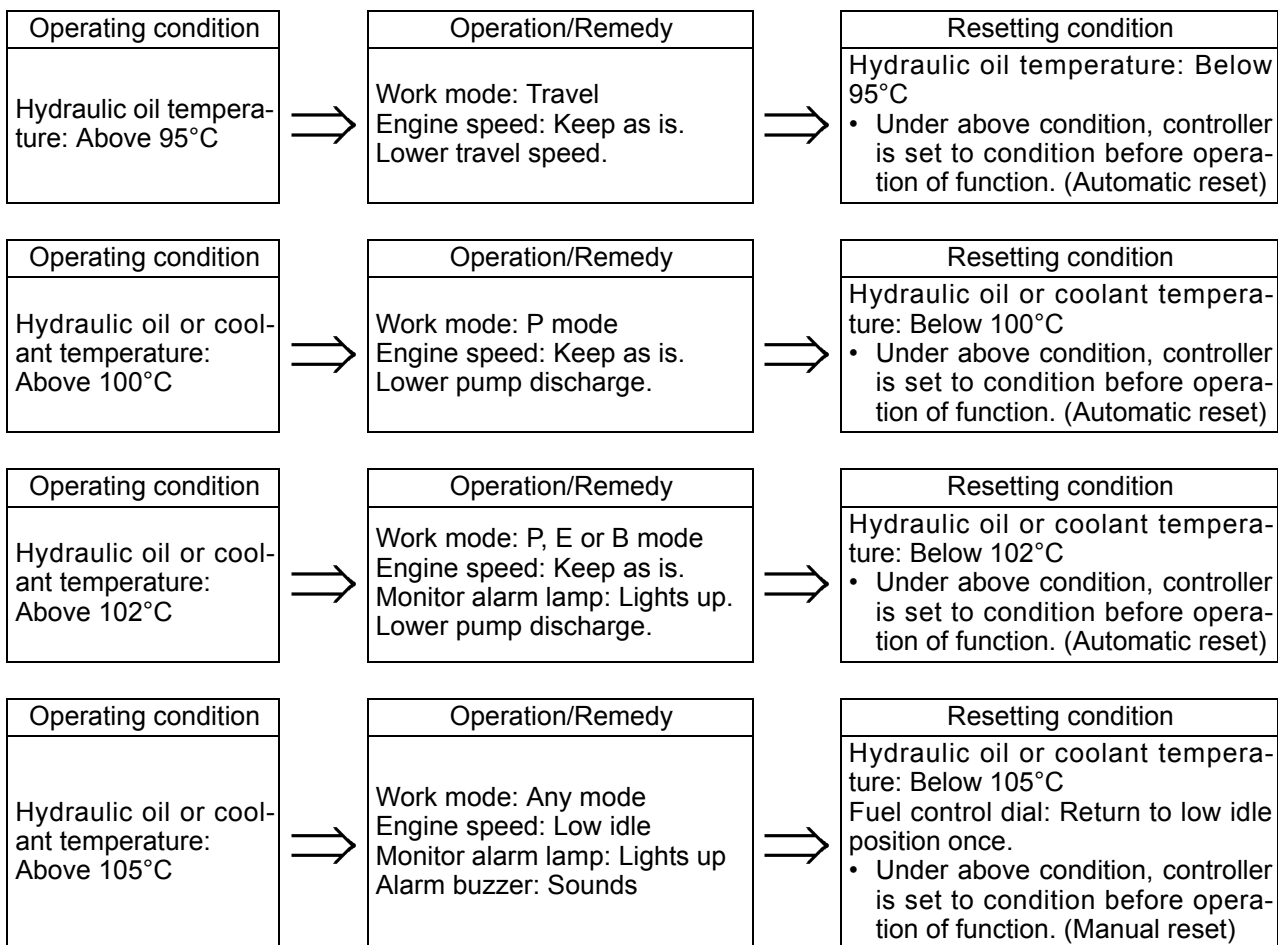
- The engine automatic warm-up function increases the engine speed to warm up the engine if coolant temperature is too low after the engine starts.
- The overheat prevention function reduces the pump load when coolant or hydraulic oil temperature is too high during operation to protect the engine from overheating.

1) Auto-warm-up function

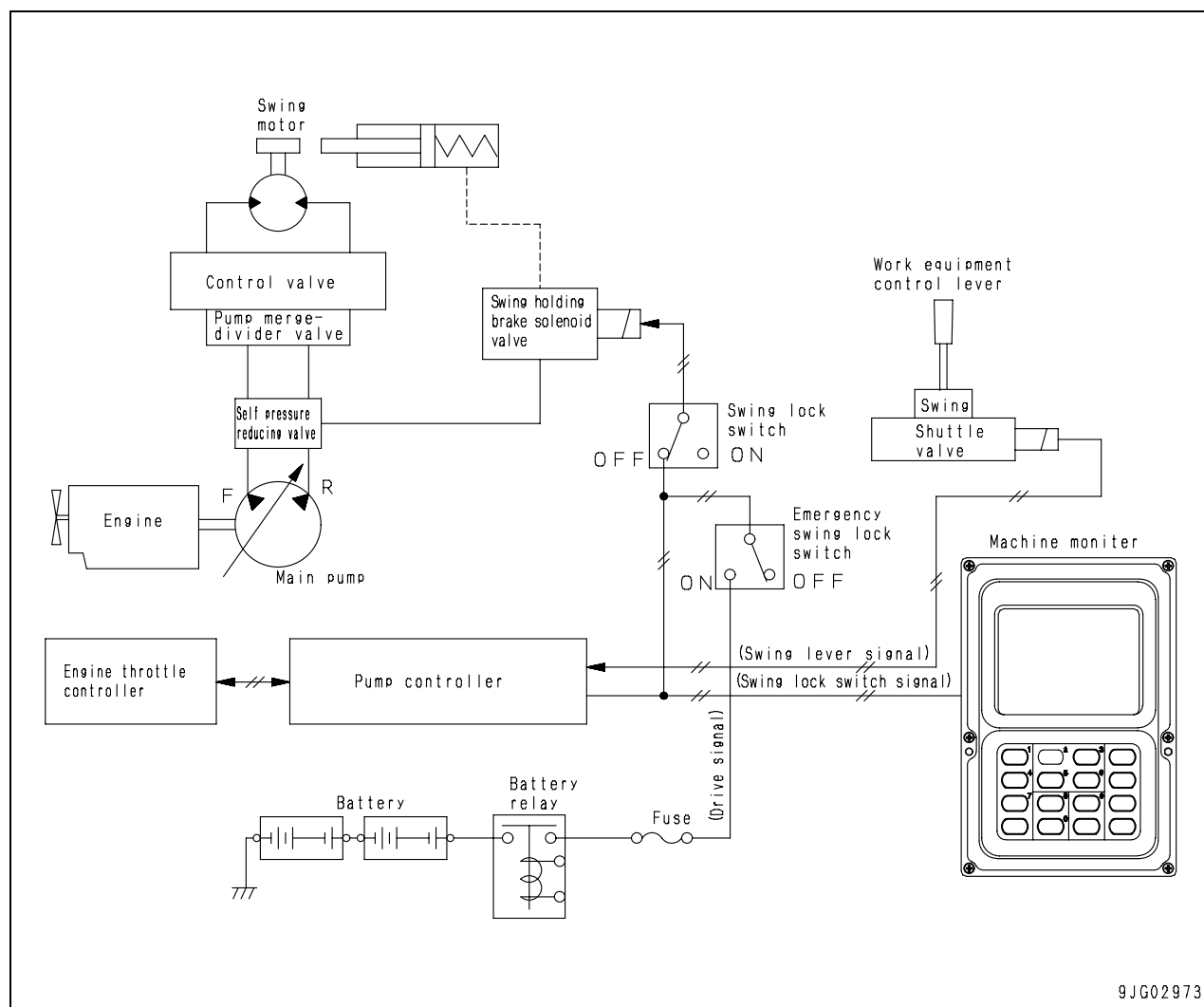
- After the engine is started, if the engine coolant temperature is low, the engine speed is raised automatically to warm up the engine.

**2) Overheat prevention function**

- If the engine coolant temperature rises too high during work, the pump load and engine speed are reduced to protect the engine from overheating.
- This function is turned on when the coolant temperature rises above 95°C.



Swing control function



Function

The swing lock and swing holding brake function are provided as a swing control function.

1) Swing lock and swing holding brake function

- The swing lock function (manual) is used to lock machine from swinging at any position. The swing holding brake function (automatic) is used to prevent hydraulic drift after the machine stops swinging.
- Operation of swing lock switch and swing lock/holding brake

Lock switch	Lock lamp	Function	Operation
OFF	OFF	Swing holding brake	If swing lever is set in neutral, swing brake operates in about 5 sec. If swing lever is operated, brake is released and machine can swing freely.
ON	ON	Swing lock	Swing lock operates and machine is locked from swinging. Even if swing lever is operated, swing lock is not reset and machine does not swing.

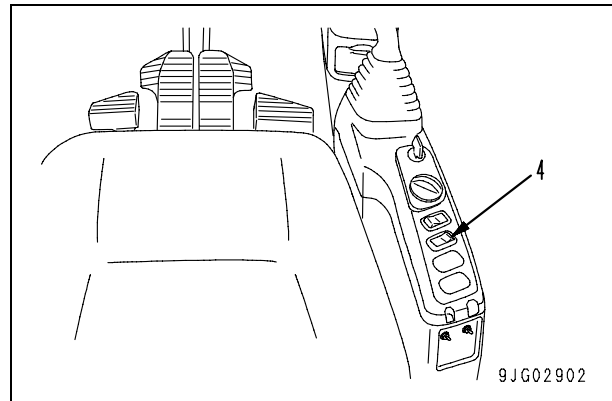
Swing holding brake release switch

- If the controller, etc. has a problem, the swing holding brake does not work normally, and the machine cannot swing, the swing lock can be reset with the swing holding brake release switch.
- Even if the swing holding brake release switch is turned on, if the swing lock switch is turned on, the swing brake is not released.
- If the swing lock is reset, only the hydraulic brake is applied by the safety valve. Note that if swinging is stopped on a slope, the upper structure may swing by its gravity.

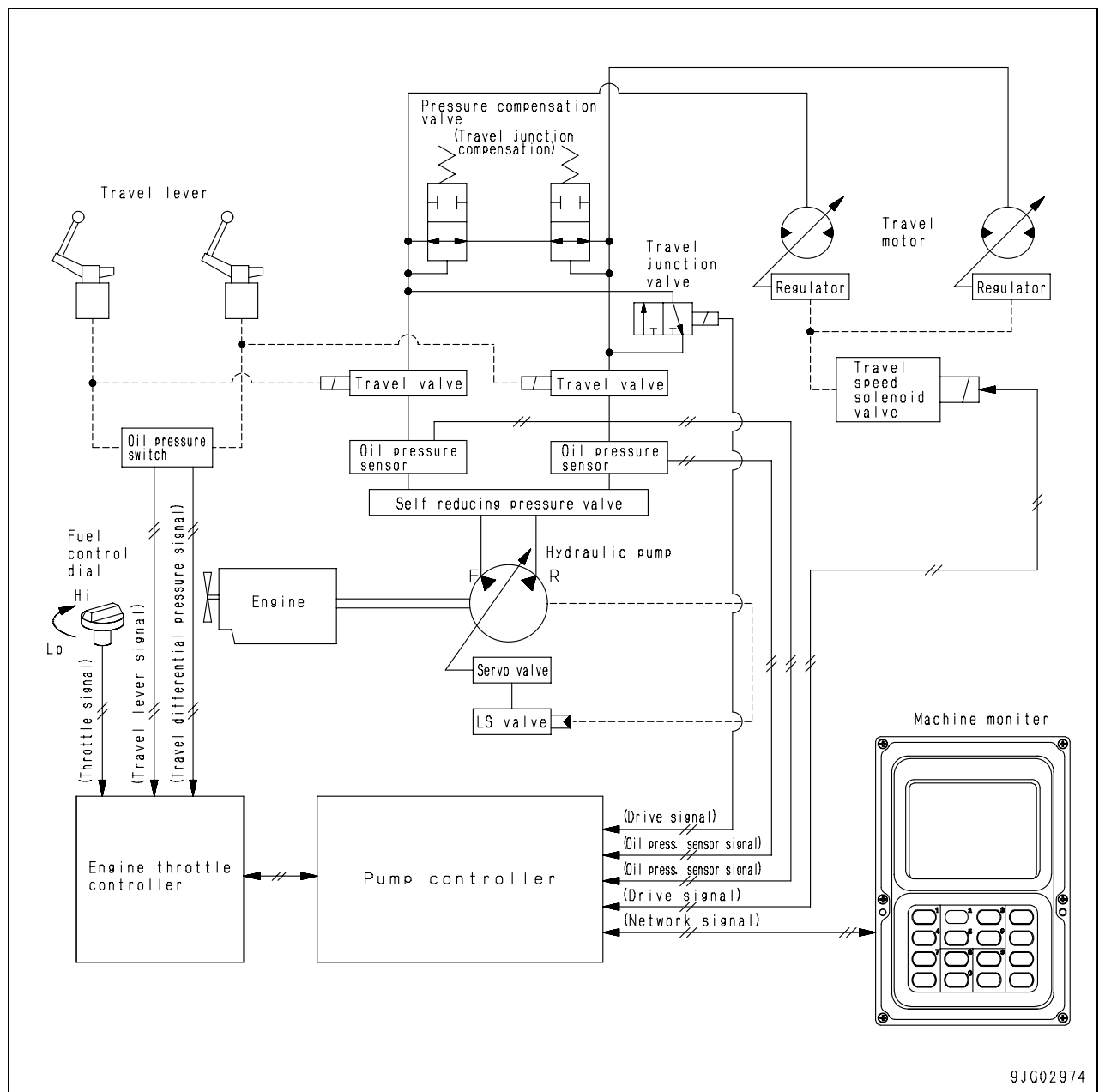
Swing holding brake release switch	ON (when controller has trouble)		OFF (when controller is normal)	
Swing lock switch	ON	OFF	ON	OFF
Swing brake	Swing lock is turned on.	Swing lock is canceled.	Swing lock is turned on.	Swing holding brake is turned on.

2) Quick hydraulic oil warm-up function when swing lock switch is turned on

- If swing lock switch (4) is turned on, the pump cut-off function is cancelled and the relief pressure rises from 34.8 MPa {355 kg/cm²} to 37.2 MPa {380 kg/cm²}. If the work equipment is relieved under this condition, the hydraulic oil temperature rises quickly and the warm-up time can be shortened.



Travel control function



Function

- The machine is provided with a function that ensures travel performance best fit to the type of work and jobsite by controlling pumps during travel or allowing operator to change travel speed automatically or manually.

1) Pump control function during travel

- If the machine travels in a work mode other than P mode, the work mode and the engine speed are kept as they are and the pump absorption torque is increased.
- For details, see "Engine and pump composite control function."

2) Travel speed change function

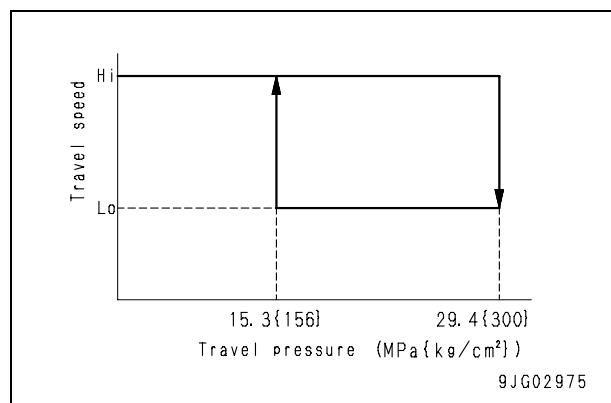
- 1] Manual change with travel speed switch
If one of "Lo" and "Hi" is selected with the travel speed switch, the pump controller controls the pump capacity and motor capacity at each gear speed as shown below to change the travel speed.

Travel speed switch	Lo (Low speed)	Hi (High speed)
Pump capacity (%)	100	100
Motor capacity	Max.	Min.
Travel speed (km/h)	3.4	5.5

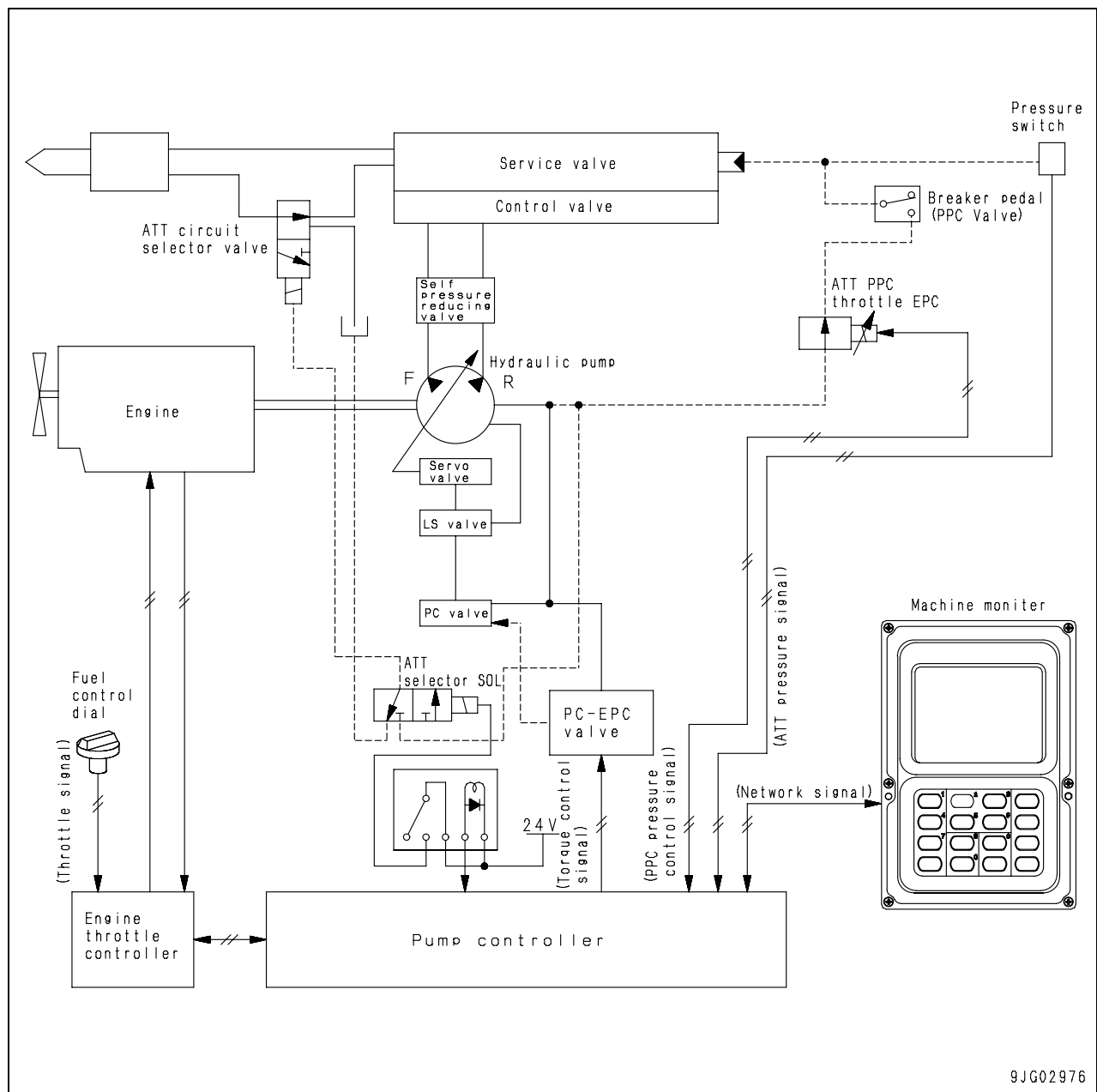
- 2] Automatic change by engine speed
If the fuel control dial is used to set the engine speed to less than 1,500 rpm, the travel speed changes to "Lo" when the machine is travelling in "Hi", and the travel speed will not change to "Hi".

- 3] Automatic change by pump discharge pressure

When travelling with the travel speed switch set to "Hi", if the load increases, such as when travelling uphill, and the travel pressure goes above 29.4 MPa {300 kg/cm²} for more than 0.5 sec, the travel motor capacity will automatically change to low speed (equivalent to "Lo"). (The travel speed switch will stay at "Hi".) If the load decreases, such as when travelling on level ground or travelling downhill, and the travel pressure goes below 15.3 MPa {156 kg/cm²} for more than 0.5 sec, the travel motor capacity will automatically change and will return to "Hi".



Attachment flow control and circuit selector function (if equipped)



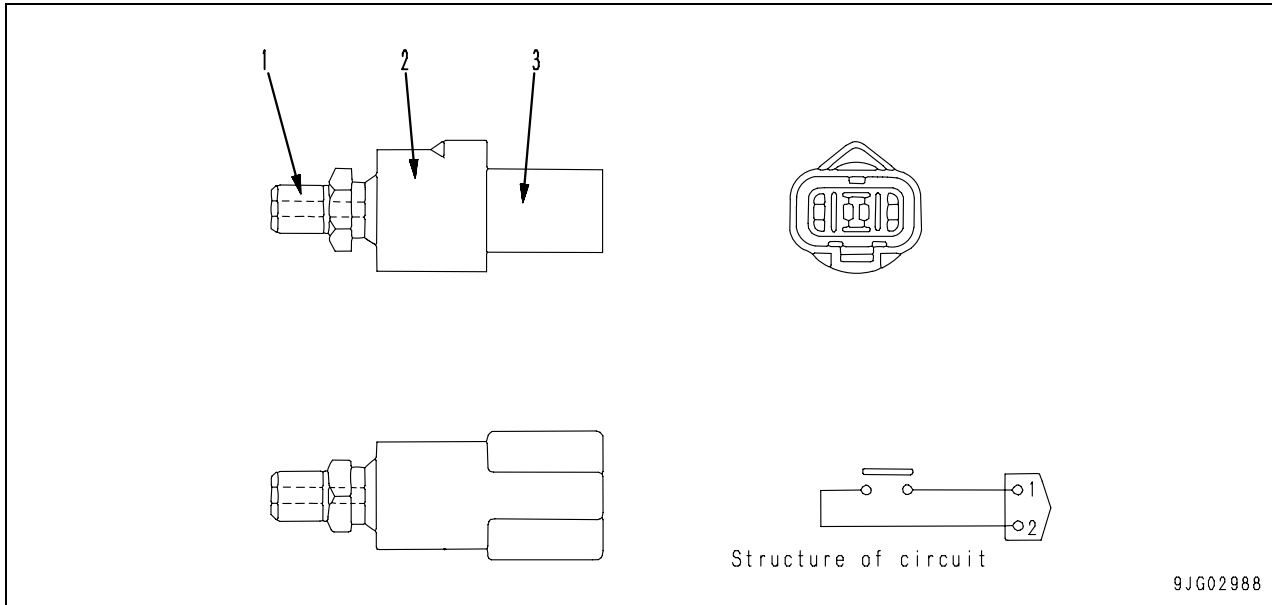
9JG02976

Function

- This function is available only with the attachment specification.
- The function acts as follows according to the flow command and working mode from the monitor.
 - 1) It throttles the attachment PPC pressure and controls the flow when the pedal is depressed fully.
 - 2) In B mode and the other modes, it switches to attachment single acting (B) or double acting (other modes).

System component parts

PPC oil pressure switch



1. Plug
2. Switch
3. Connector

Specifications

Type of contacts: Normally open contacts

Operating (ON) pressure:

$0.5 \pm 0.1 \text{ MPa}$ $\{5.0 \pm 1.0 \text{ kg/cm}^2\}$

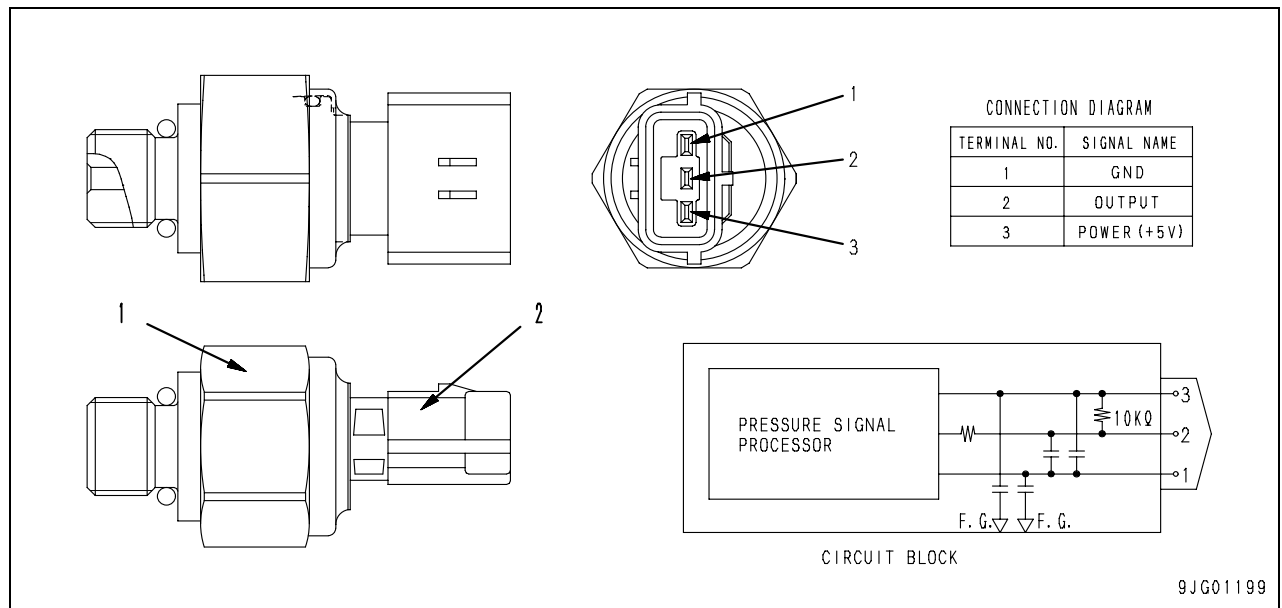
Resetting (OFF) pressure:

$0.3 \pm 0.05 \text{ MPa}$ $\{3.0 \pm 0.5 \text{ kg/cm}^2\}$

Function

- The junction block has 6 PPC oil pressure switches.
- This sensor detects the operating condition of each actuator by the PPC pressure and transmit it to the pump controller.

PPC oil pressure sensor



1. Sensor
2. Connector

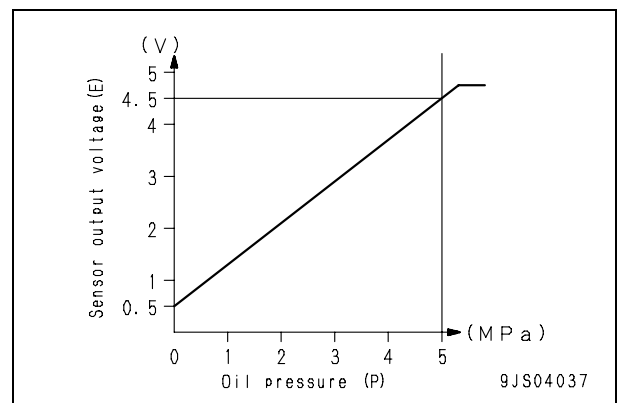
Function

- The pump pressure sensor is installed to the input circuit of the control valve.
- It converts the pump discharge pressure into a voltage and transmits it to the pump controller.

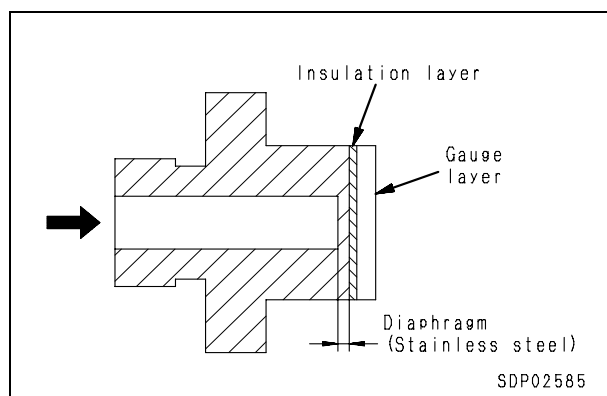
Operation

- The oil pressure is applied to the diaphragm of the oil pressure sensor from the pressure intake part, the diaphragm is deformed.
- The deformation in the diaphragm causes the resistance of the gauge to change. This causes a change in the output voltage, which is transmitted to the amplifier (voltage amplifier).
- The amplifier magnifies output voltage (E) and transmits it to the pump controller.

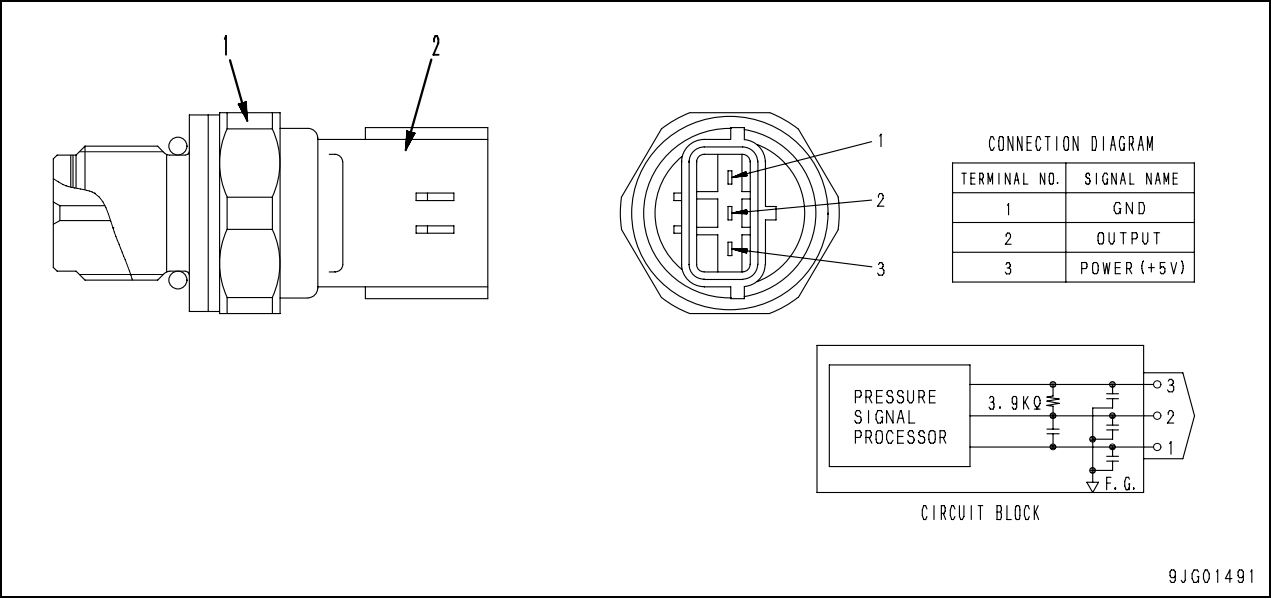
- The relationship between the pressure applied to sensors (P) and output voltage (E) is shown in the figure below.



$$E = 0.08 \{0.008\} \times P + 0.5$$



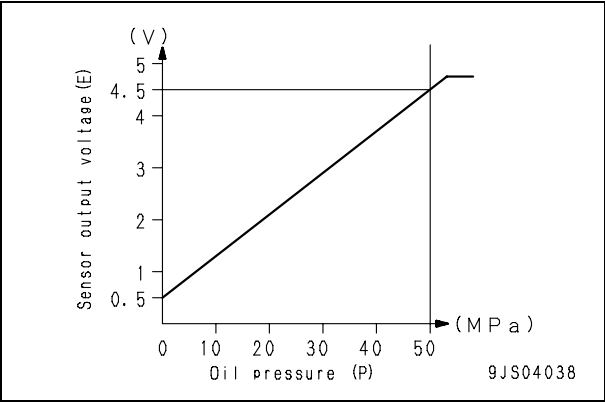
Pump pressure sensor (high pressure)



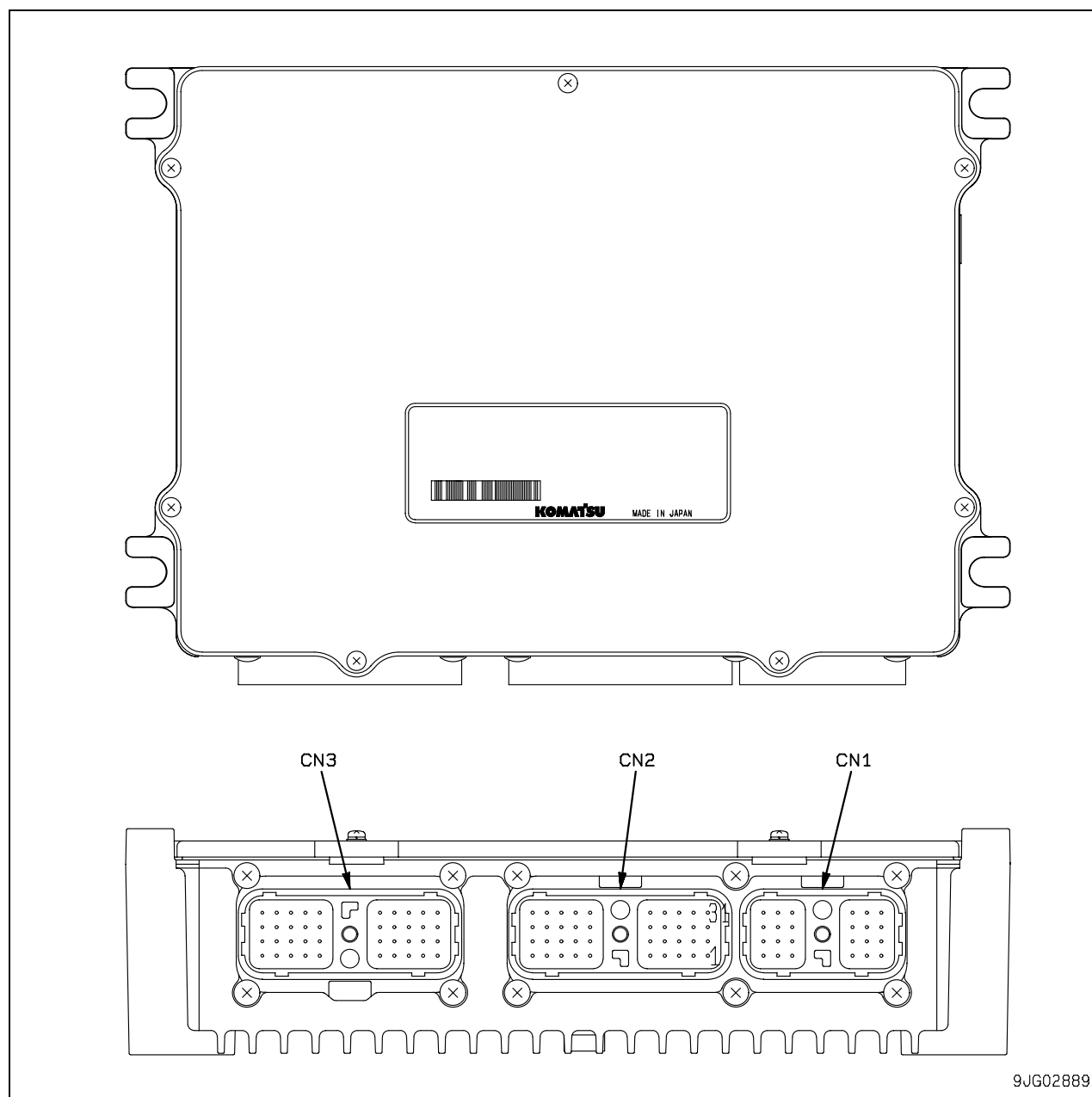
- 1. Sensor
- 2. Connector

Operation

- The relationship between the pressure applied to sensors (P) and output voltage (E) is shown in the figure below.



Pump controller



CN-CP01

Pin No.	Signal name	Input/output
1	Boom bottom pressure sensor *1	Input
2	R pump pressure sensor	Input
3	Arm angle potentiometer *1	Input
4	Signal GND	—
5	NC	Input
6	NC	Input
7	Overload sensor (Analog)	Input
8	F pump pressure sensor	Input
9	Boom angle potentiometer *1	Input
10	Signal GND	—
11	Knob SW	Input
12	NC	Input
13	Swing (left) pressure sensor	Input
14	Boom head pressure sensor *1	Input
15	NC	Input
16	SENS_PWR	Output
17	Key SW (Terminal C)	Input
18	NC	Input
19	Swing (right) pressure sensor	Input
20	NC	Input
21	GND (Analog GND)	—
22	POT_PWR	Output
23	Key SW (Terminal ACC)	Input
24	Arm crane relay actuated monitoring *1	Input

CN-CP02

Pin No.	Signal name	Input/output
1	NC	Output
2	Swing prolix SW	Input
3	NC	Input
4	NC	Input
5	NC	Input
6	Overload alarm effective SW	Input
7	Model selection 4	Input
8	ATT circuit selector SOL signal *2	Output
9	NC	Output
10	NC	Input
11	NC	Output
12	CAN shield	—
13	Model selection 5	Input
14	NC	Output
15	NC	Input
16	Travel steering signal pressure SW	Input
17	Model selection 3	Input
18	Arm crane drive signal *1	Output
19	NC	Output
20	NC	Input
21	NC	Input/output
22	CAN0_L	Input/output
23	NC	Input/output
24	Flash memory write permission signal	Input
25	NC	Input
26	NC	Input
27	Model selection 2	Input
28	NC	Input
29	NC	—
30	NC	Input
31	NC	—
32	CAN0_H	Input/output
33	NC	Input/output
34	NC	—
35	Service valve pressure SW *2	Input
36	NC	Input
37	Model selection 1	Input
38	Swing lock SW	Input
39	GND (Pulse GND)	—
40	NC	Input

*1. Arm crane specification

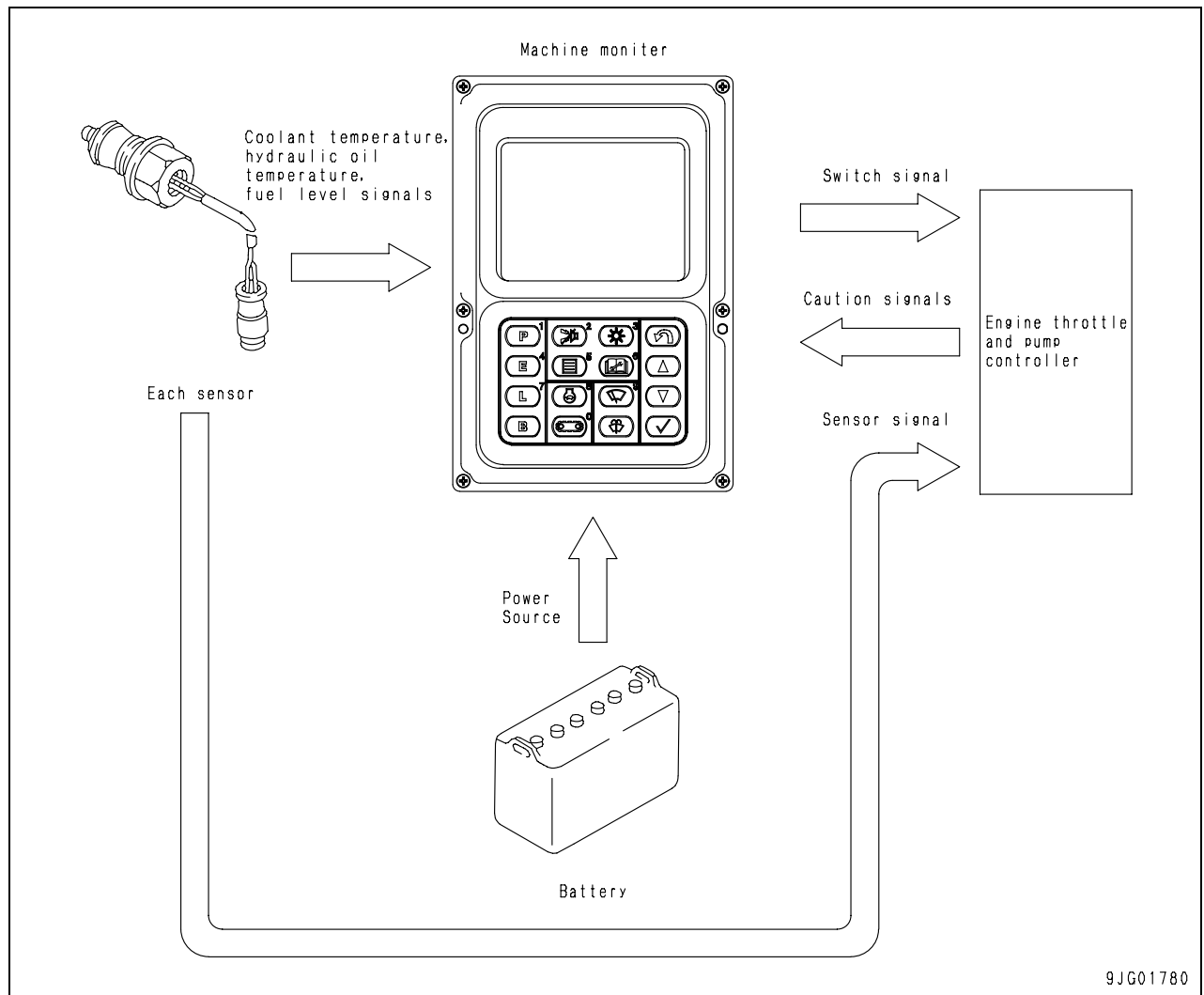
*2. Only ATT specification

CN-CP03

Pin No.	Signal name	Input/output
1	VB (Controller PWR)	Input
2	VIS (Solenoid PWR)	Input
3	SOL_COM (Solenoid common GND)	—
4	Battery relay drive signal	Output
5	NC	Output
6	NC	Output
7	Travel junction SOL	Output
8	NC	Output
9	Bucket CURL pressure SW	Input
10	Boom raise pressure SW	Input
11	VB (Controller PWR)	Input
12	VIS (Solenoid PWR)	Input
13	SOL_COM (Solenoid common GND)	—
14	KEY_SIG	Input
15	NC	Output
16	PC-EPC	Output
17	Pump merge-divider solenoid	Output
18	NC	Output
19	Bucket dump pressure SW	Input
20	Boom lower pressure SW	Input
21	GND (Controller GND)	—
22	NC	Input
23	SOL_COM (Solenoid common GND)	—
24	KEY_SIG	Input
25	NC	Output
26	Service flow adjustment EPC (1) *2	Output
27	Travel Hi/Lo selector SOL	Output
28	2-stage relief SOL	Output
29	NC	Input
30	Arm IN pressure SW	Input
31	GND (Controller GND)	—
32	GND (Controller GND)	—
33	GND (Controller GND)	—
34	NC	—
35	NC	Output
36	NC	Output
37	Swing holding brake SOL	Output
38	NC	Output
39	Travel pressure SW	Input
40	Arm OUT pressure SW	Input

*2. Only ATT specification

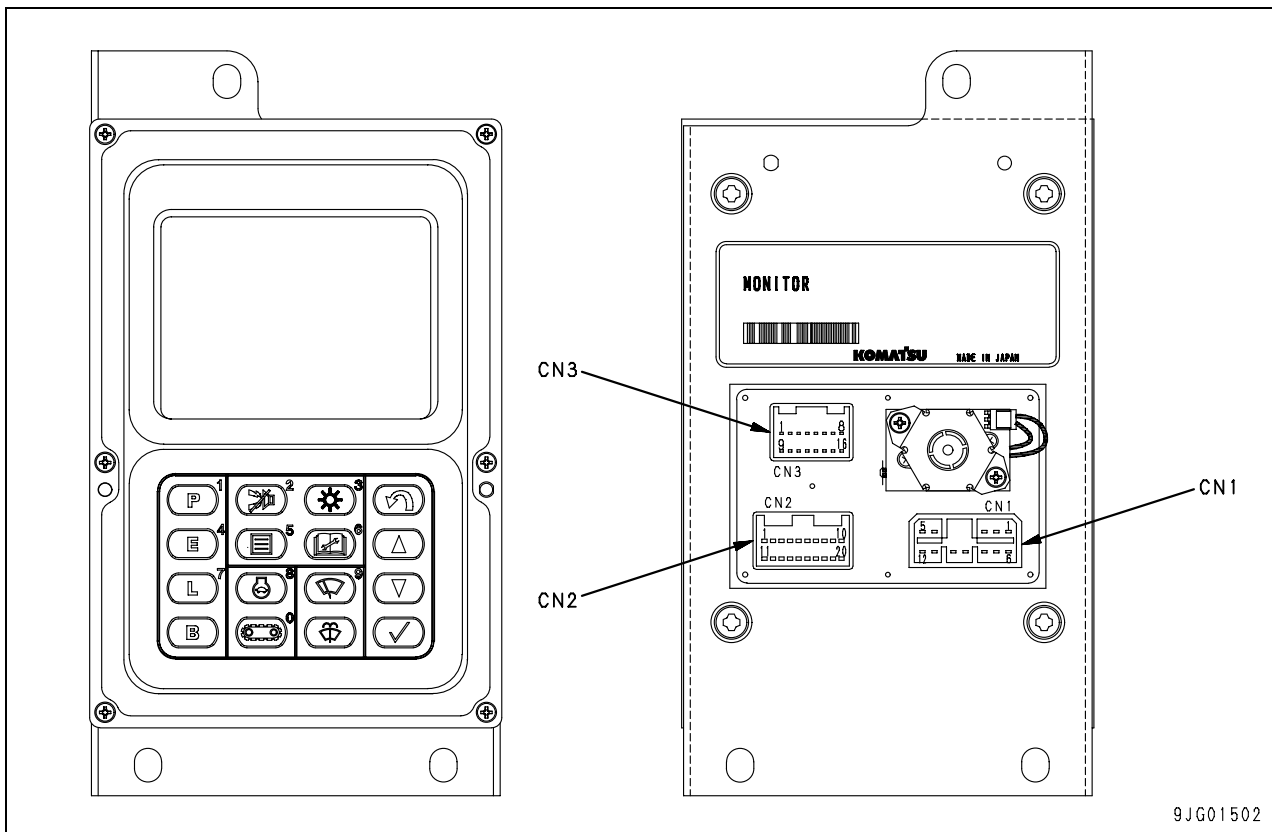
Monitor system



9JG01780

- The monitor system notifies the operator of machine status. It monitors the condition of the machine with sensors installed on various parts of the machine, processes and immediately displays the obtained information on the panel. The information that appears on the panel is roughly divided as follows.
 1. Alarms that are issued when the machine has troubles
 2. Machine status, including coolant temperature, hydraulic oil temperature and fuel level
- The machine monitor also has various mode selector switches and functions to operate the machine control system.

Machine monitor



Outline

- The machine monitor has the functions to display various items and the functions to select modes and electric parts.
- The machine monitor has a CPU (Central Processing Unit) in it to process, display, and output the information.
- The monitor display employs an LCD (Liquid Crystal Display). The switches are flat sheet switches.

Input and output signals

CN-1

Pin No.	Signal name	Input/output
1	Key ON	Input
2	Key ON	Input
3	Window washer motor output	output
4	Starting signal	Input
5	Limit switch (W)	Input
6	GND	–
7	GND	–
8	VB+	Input
9	Wiper motor (+)	output
10	Wiper motor (–)	output
11	Buzzer ON signal	Input
12	Limit switch (P)	Input

CN-2

Pin No.	Signal name	Input/output
1	Engine coolant temperature	Input
2	Fuel level	Input
3	Radiator coolant level	Input
4	(Hydraulic oil level)	Input
5	Air cleaner clogging	Input
6	NC (*)	Input
7	Engine oil pressure	Input
8	Engine oil level	Input
9	Network signal	Input/output
10	Network signal	Input/output
11	Charge amount	Input
12	Hydraulic oil temperature (analog)	Input
13	GND (for analog signal)	–
14	Buzzer drive	Input
15	Limit switch (window)	Input
16	Buzzer cancel	Input
17	Swing lock	Input
18	Preheating	Input
19	Light switch	Input
20	Network GND	–

*: Never connect to NC or malfunctions or failures will occur.

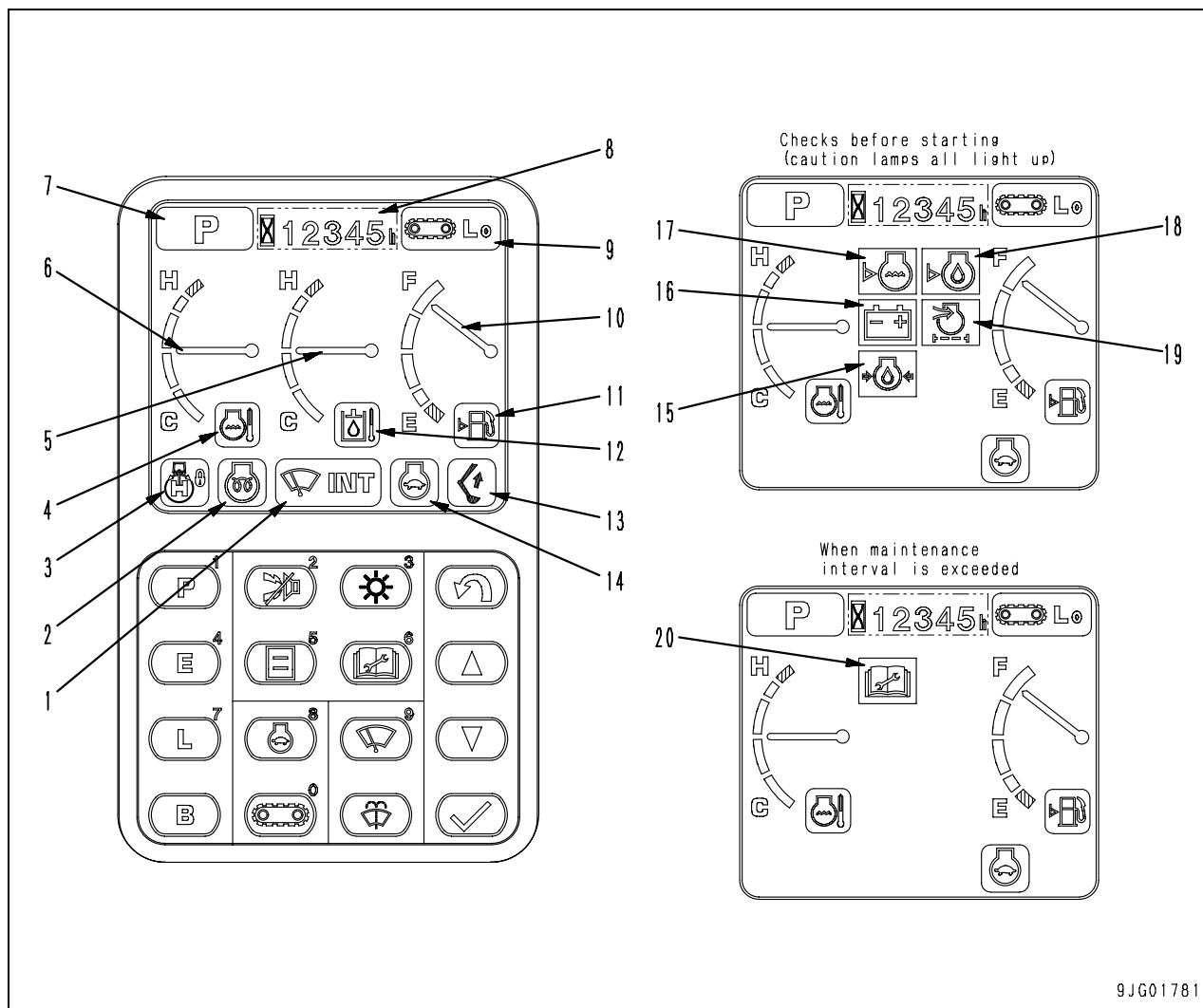
CN-3

Pin No.	Signal name	Input/output
1	NC (*)	Input
2	NC (*)	Input
3	NC (*)	Input
4	NC (*)	Input
5	NC (*)	Input
6	NC (*)	Input
7	RS230C CTS	Input
8	RS230C RXD	Input
9	RS230C RXD	Input/output
10	RS230C RXD	Input/output
11	BOOTSW	Input
12	NC (*)	Input
13	GND	–
14	CAN (SHIELD)	Input
15	CAN (+)	Input
16	CAN (–)	Input

*: Never connect to NC or malfunctions or failures will occur.

Monitor control and display portion



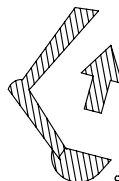
Monitor portion

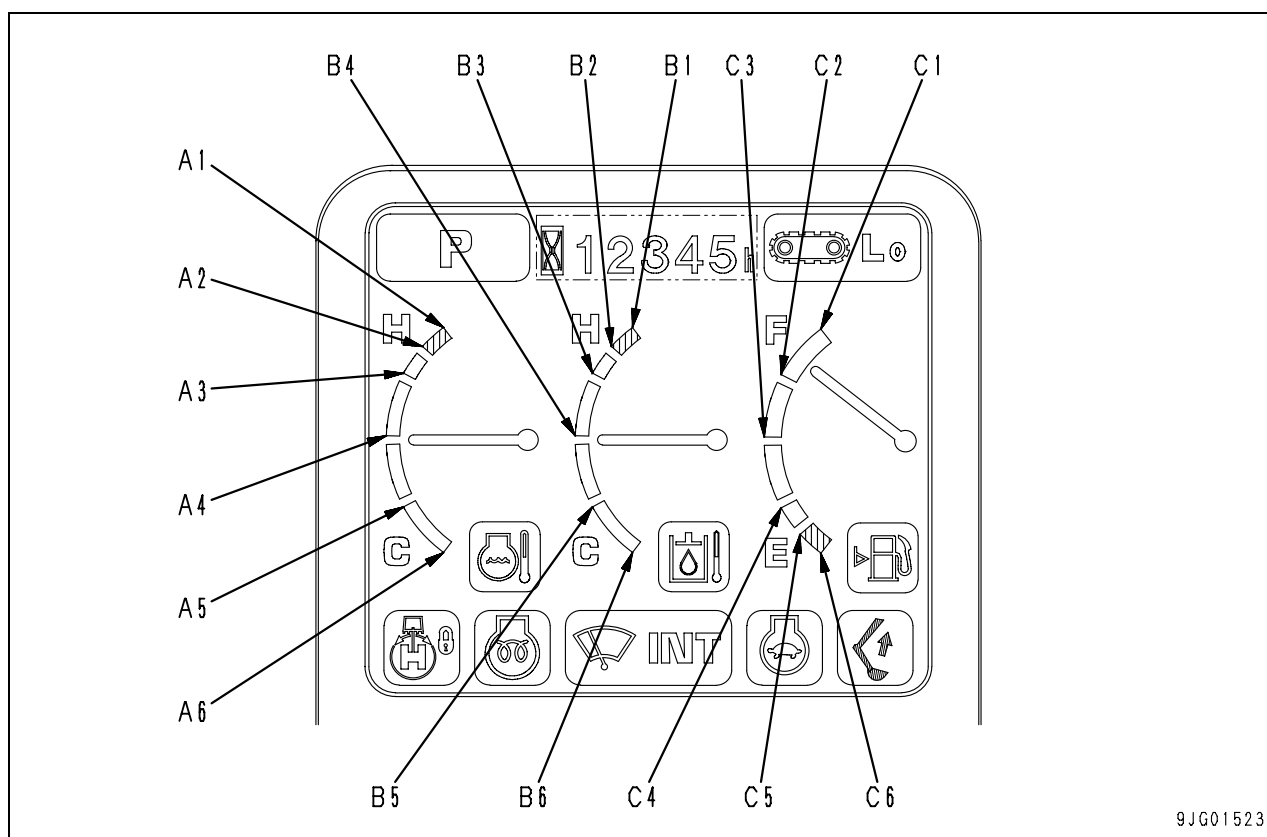


1. Wiper monitor
2. Preheating monitor
3. Swing lock monitor
4. Engine coolant temperature monitor
5. Hydraulic oil temperature gauge
6. Engine coolant temperature gauge
7. Working mode monitor
8. Service monitor
9. Travel speed monitor
10. Fuel gauge

11. Fuel level monitor
12. Hydraulic oil temperature monitor
13. Power maximizing monitor
14. Auto-deceleration monitor
15. Engine oil pressure monitor
16. Charge level monitor
17. Radiator coolant level monitor
18. Engine oil level monitor
19. Air cleaner clogging monitor
20. Maintenance time warning monitor

Monitor items and display






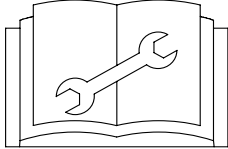
Symbol	Display item	Display method		
 SAT00098	Swing lock	Swing lock switch	Swing holding brake release switch	Swing lock monitor
		OFF	OFF	OFF
		ON	OFF	ON
		OFF	ON	Flashes
		ON	ON	ON
 SAP00526	Preheating	Continuous set time	Preheating monitor status	
		Up to 30 sec.	ON	
		From 30 sec. to 40 sec.	Flashes	
		More than 40 sec.	OFF	
 SJP08778	Power max.	Power max. switch status	Power max. monitor status	
		Being pressed	Lights up but goes out after approx. 9 sec. when kept pressed	
		Not being pressed	Flashes	
	Engine coolant temperature	See gauge display on the next page		
	Hydraulic oil temperature			
	Fuel level			



Gauge	Range	Temperature or volume	Indicator	Buzzer sound
Engine coolant temperature (°C)	A1	105	Red	○
	A2	102	Red	
	A3	100	Green	
	A4	80	Green	
	A5	60	Green	
	A6	30	White	
Hydraulic oil temperature (°C)	B1	105	Red	
	B2	102	Red	
	B3	100	Green	
	B4	80	Green	
	B5	40	Green	
	B6	20	White	
Fuel level (ℓ)	C1	189	Green	
	C2	164	Green	
	C3	132	Green	
	C4	68	Green	
	C5	41	Green	
	C6	29	Red	


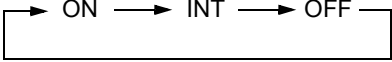

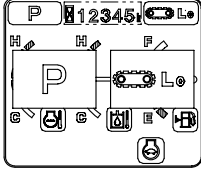
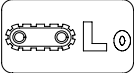
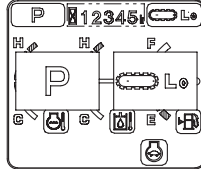

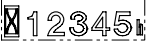
Checks before starting (all symbols light up), when maintenance interval is exceeded.

If the checks before starting or maintenance interval is exceeded items light up, the display of the hydraulic oil temperature gauge and the hydraulic oil temperature monitor disappear and the following symbols are displayed.

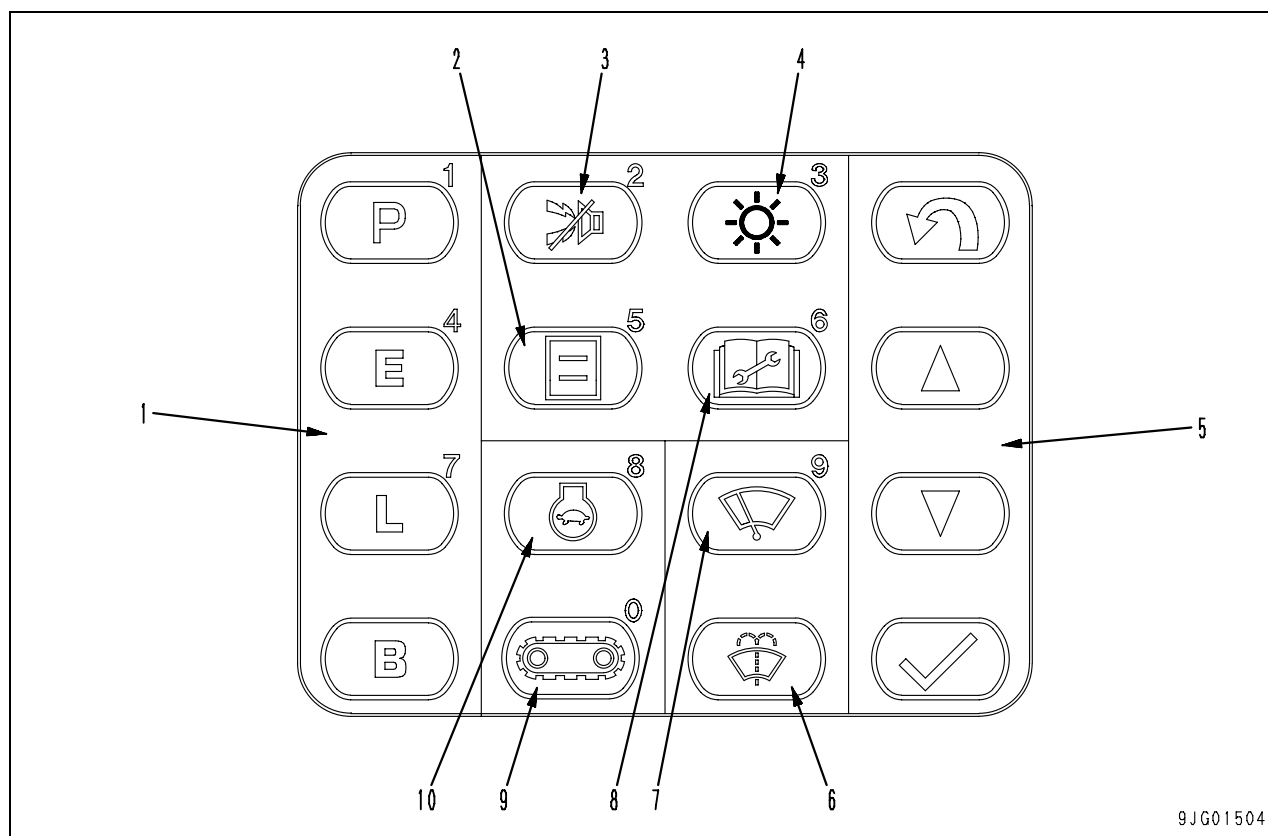
Symbol	Display item	Check before starting item	When engine is stopped	When engine is running
 9JG02984	Engine oil pressure	●	—	When abnormal, lights up and buzzer sounds
 9JG02985	Battery charge	●	—	Lights up when abnormal
 SAP00519	Radiator coolant level	●	Lights up when abnormal	When abnormal, lights up and buzzer sounds
 SAP00523	Engine oil level	●	Lights up when abnormal	—
 SAP00521	Air cleaner clogging	●	—	Lights up when abnormal
 SJP08780	Maintenance		Lights up when there is a warning. Lights up for only 30 sec. after key is turned ON, then goes out.	

Symbols appear in the order in which they occur from the upper left. When symbols are displayed, if the hydraulic oil temperature is high or low, only its symbol is displayed.

Condition of hydraulic oil	Colour of symbol
Low temperature (Max. B6 or equivalent)	Black on white background
Normal (B6 – B2)	No display
High temperature (Min. B2)	White on red background

Display category	Symbol	Display item	Display range	Display method
Monitor	 SJP08781	Wiper		Displays set condition
	 9JG01235	Working mode	 P, E, L, B 9JG01543	Displays set mode
	 9JG01236	Travel speed	 Lo, Hi 9JG01565	Displays set speed
	 9JG01237	Auto-deceleration	ON ⇄ OFF	Displays actuation status
Service meter	 SJP08785	Service meter indicator	When service meter is working	Lights up when service meter is working

Switches



1. Working mode selector switch
2. Selector switch
3. Buzzer cancel switch
4. Display brightness, contrast adjustment switch
5. Control switch
6. Window washer switch
7. Wiper switch
8. Maintenance switch
9. Travel speed selector switch
10. Auto-deceleration switch

Working mode selector switch

Press one of the P, E, B and L switches to set the desired working mode. It is possible to check which mode is active with the working mode monitor. The relationship between each working mode and the monitor display is shown in the table below.

Switch that is pressed	Display	Working mode status after setting
[P]	P	P mode (default)
[E]	E	E mode
[L]	L	L mode
[B]	B	B mode

Selector switch

This is used when making detailed settings in each working mode. For details, see "Attachment flow control function".

Buzzer cancel switch

Pressing this switch when the alarm buzzer is making sound stops the alarm buzzer.

If a new abnormality is detected, the alarm buzzer sounds.

Depending on the alarm buzzer type, it does not stop even if you press the buzzer cancel switch.

Maintenance switch

Check the condition of the maintenance items. For details, see "Maintenance function".

Auto-deceleration switch

The auto-deceleration switch toggles the auto-deceleration function on and off. When the working mode is switched, it is automatically set to ON. When it is set to ON, the auto-deceleration monitor appears.

Travel speed selector switch

Each time the travel speed selector switch is pressed, the travel speed changes as shown below.

Lo → Hi → Lo →.....

The travel speed settings can be viewed on the monitor. The relationship between the speed setting and the monitor display is shown in the table below.

Display	Setting
Crawler symbol + Lo	Low speed (default)
Crawler symbol + Hi	High speed

Wiper switch

Each time the wiper switch is pressed, the wiper setting changes as shown below.

OFF → INT → ON → OFF →.....

The wiper settings can be viewed on the wiper monitor. The relationship between the wiper setting and the monitor display is shown in the table below.

Display	Setting	Wiper actuation status
None	OFF	Stowing stopped or now stowing
Wiper symbol + INT	INT	Intermittent actuation
Wiper symbol + ON	ON	Continuous actuation

Window washer switch

While the switch is being pressed, window washer liquid is sprayed out. There is a time delay before the wiper starts.

Control switch

This is used for control when using the maintenance function or select function. For details, see each function.

Display brightness, contrast adjustment switch

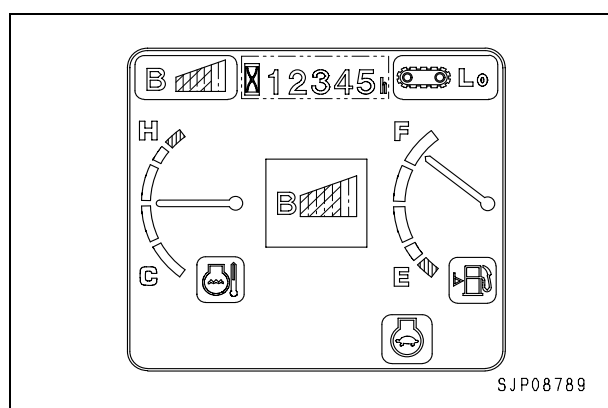
This function is used to adjust the brightness and contrast of the display. For details, see each function.

Select mode function

1. Setting of oil flow

- This is used when setting the flow in each working mode.
- It is available when genuine attachment piping is installed and "Attachment installed" is selected with the initial value setting function on the service menu.
- It is possible to check on the working mode monitor if this function can be used.

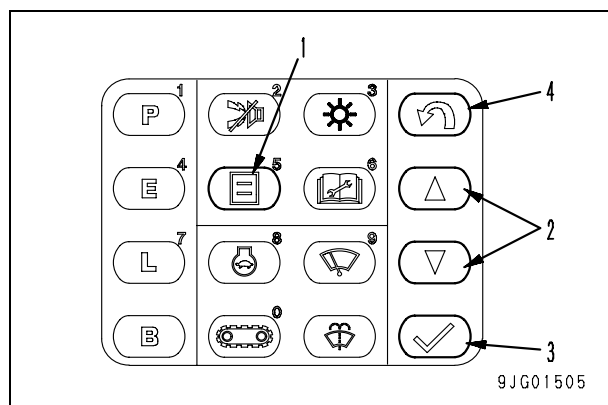
Working mode	Monitor display
P mode	[P] + crusher symbol
E mode	[E] + crusher symbol
B mode	[B] + flow symbol



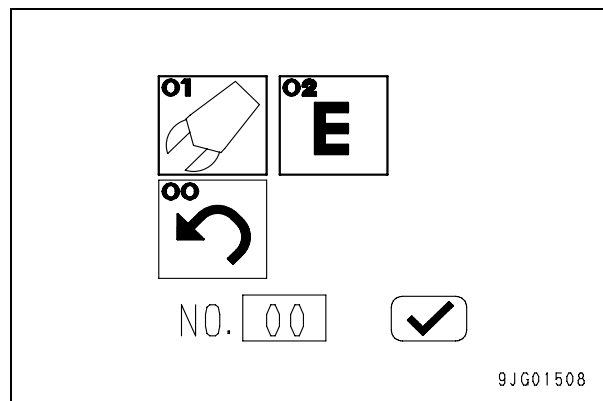
Method of use

- ★ Carry out the setting on the normal screen
P mode, E mode

1) Press select switch (1).

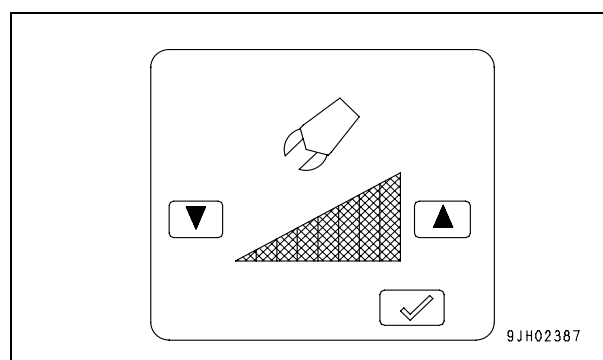


2) When the screen changed as below, select "01" by operating switch (2), and press input confirmation switch (3).



3) Press control switch (2) and select the flow level.

Control switch	Actuation
	Flow level bar graph extends to the right
	Flow level bar graph retracts to the left



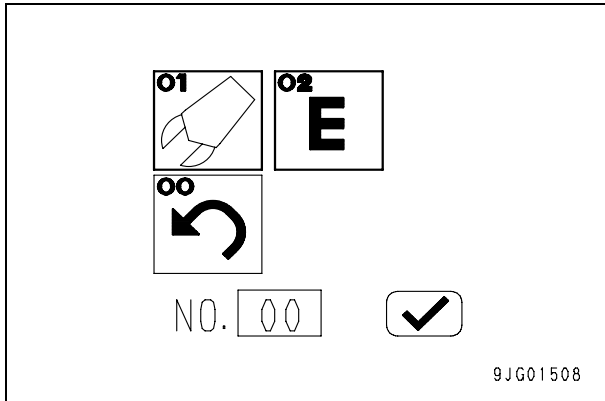
4) After completing the level selection, press input confirmation switch (3). The selection flow level is confirmed and the screen moves to the normal screen. When input confirmation switch (3) is pressed, the attachment flow is updated. The relationship between the flow level and the flow is shown in the table below.

Flow level	Flow (ℓ/min)	Remarks
8	290	Default
7	240	
6	170	
5	120	
4	100	
3	80	
2	55	
1	30	

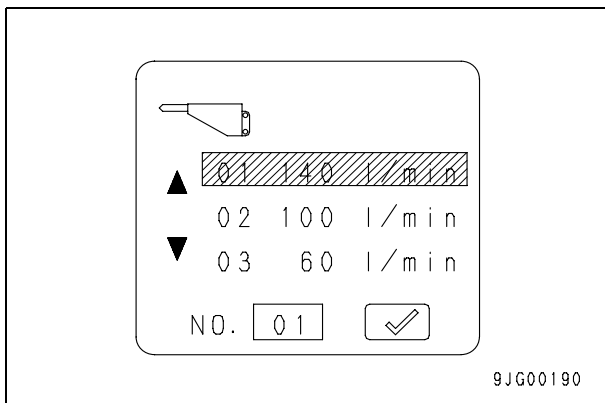
- ★ Flow level is not changed until the input confirmation switch (3) is pressed. It is, therefore, possible not to change the flow level by pressing return switch (4) to return to the normal screen.

B mode

- 5) Press select switch (1).
- 6) When the screen changed as below, select "01" by operation switch (2), and press input confirmation switch (3).



- 7) Select one of the three flow levels by moving the cursor with operation switch (2) or entering the relevant number (01, 02 or 03) with the 10-key pad.



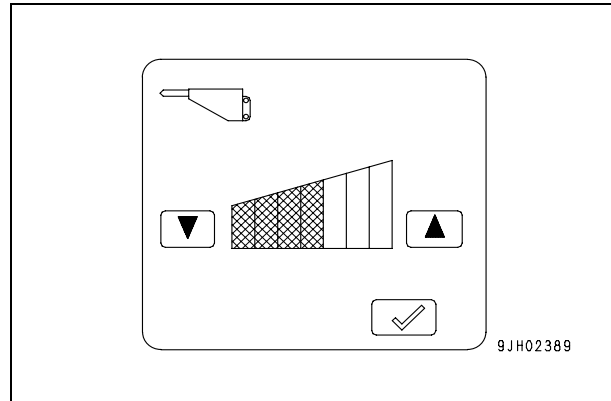
- The relationship between the flow level and the flow is shown in the table below.

No.	Flow (ℓ/min)	Remarks
01	140	Default
02	100	
03	60	

- 8) Pressing input confirmation switch (3) after selecting the flow level finalizes the selection.

- ★ Flow level is not finalized until the input confirmation switch (3) is pressed. Returning to the normal screen by pressing return switch (4) will leave the flow level setting unchanged.

- 9) After the flow level is confirmed, the screen changes to the screen shown in the diagram below. With this screen, it is possible to make fine adjustment to the flow.



Control switch	Actuation
	Flow level bar graph extends to the right
	Flow level bar graph retracts to the left

- 10) Pressing input confirmation switch (3) after selecting the flow level finalizes the selection.

- The relationship between the flow level and the flow is shown in the table below.

Flow level	When flow is 60 ℓ/min.	When flow is 100 ℓ/min.	When flow is 140 ℓ/min.	Remarks
7	90	130	170	
6	80	120	160	
5	70	110	150	
4	60	100	140	Default
3	50	90	130	
2	40	80	120	
1	30	70	110	

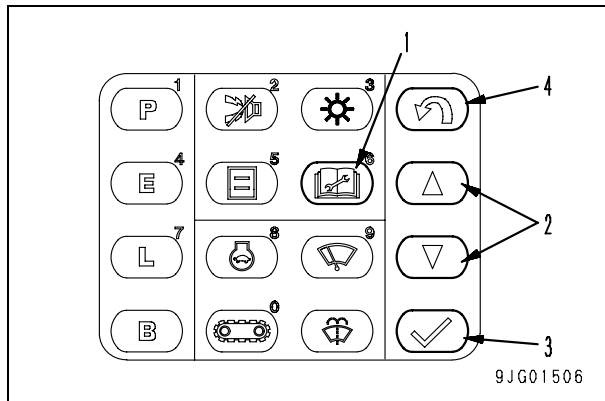
- ★ Flow level is not finalized until input confirmation switch (3) is pressed. Returning to the normal screen by pressing return switch (4) will leave the flow level setting unchanged.

- 11) Check the set value with the working mode monitor. The relationship between the display level and the set value is shown in the table below.

Display level	Set value (ℓ/min.)
8	160 or 170
7	140 or 150
6	120 or 130
5	100 or 110
4	80 or 90
3	60 or 70
2	40 or 50
1	30

Maintenance function

- This function alerts the operator when routine maintenance (replacement, inspection or filling for the 11 maintenance items) is due.
- When maintenance switch (1) is pressed, any maintenance item that is due is displayed yellow or red for 30 seconds.



- The table below shows the maintenance items and replacement intervals. The time remaining to maintenance is reduced as the machine is operated.

No.	Item	Replacement interval (Hours)
01	Engine oil	500
02	Engine oil filter	500
03	Fuel main filter	1000
41	Fuel prefilter	500
04	Hydraulic filter	1000
05	Hydraulic tank breather	500
06	Corrosion resistor	1000(*)
07	Damper case oil	1000
08	Final case oil	2000
09	Machinery case oil	1000
10	Hydraulic oil	5000

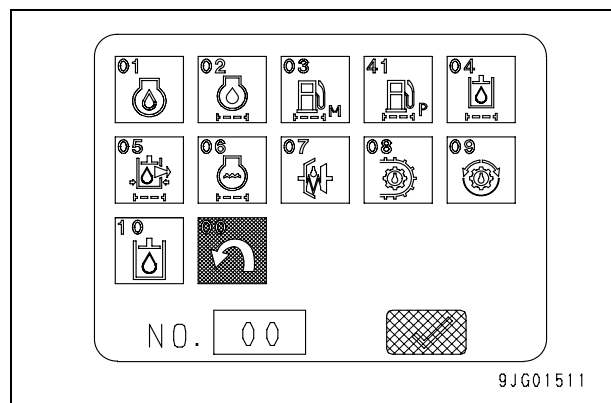
*: If equipped (To be determined)

- The content of the caution display differs according to the remaining time. The relationship is as shown in the table below.

Display	Condition
None	Remaining time for maintenance for all items is more than 30 hours
Notice display (black symbol displayed on yellow background)	There is one or more items with less than 30 hours remaining time for maintenance
Warning display (white symbol displayed on red background)	There is one or more items with less than 0 hours remaining time for maintenance

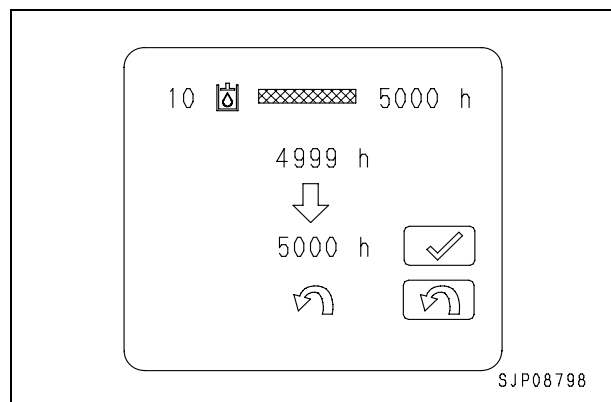
1. Method of checking maintenance items

- ★ Carry out the setting on the normal screen
- Press maintenance switch (1) and switch to the maintenance list display screen. The maintenance items are displayed as symbols on the screen.
 - Select one of the maintenance items by moving the cursor with control switch (2) or entering the relevant number (01 to 10) with the 10-key pad.
 - ★ If the remaining time is less than 30 hours, the item is displayed in yellow, and if it is less than 0 hours, it is displayed in red.

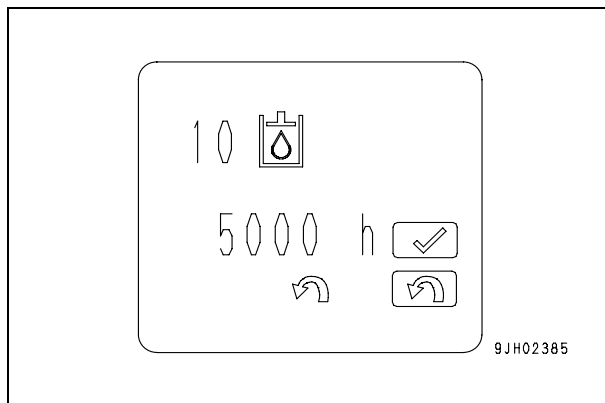


2. Maintenance operation

- After completing the selection, press input confirmation switch (3). The screen will change to the maintenance reset screen.
- The maintenance reset screen shows the time remaining before maintenance is due. To reset the remaining time, press input confirmation switch (3). When input confirmation switch (3) is pressed, the screen changes to the check screen. To return to the maintenance list screen, press return switch (4).



- 3) The check screen shows the symbol for the selected maintenance item and the set time in large letters.
- 4) To reset the remaining time, press input confirmation switch (3). The remaining time is reset and the screen returns to the maintenance list display screen. To return to the maintenance list screen without resetting the remaining time, press return switch (4).
- 5) On the maintenance list display screen, the background colour of the symbol for the item where the maintenance item was reset is the same as the background of the screen.



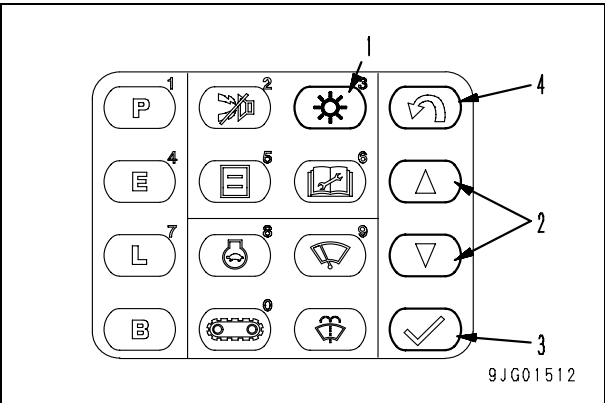
Brightness, contrast adjustment function

This function is used to adjust the brightness and contrast of the display.

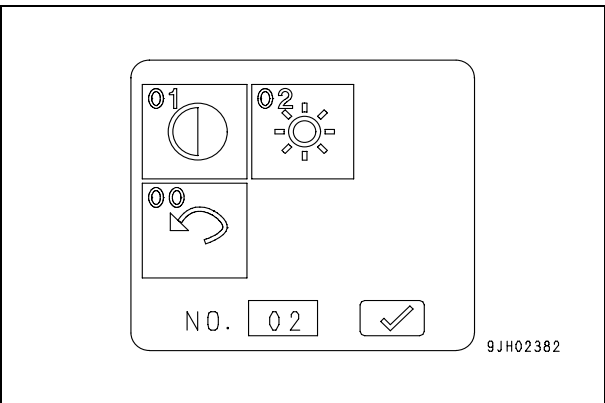
★ Carry out the setting on the normal screen

1. Adjustment method

- 1) Press display brightness/contrast adjustment switch (1) and switch to the adjustment screen.



- 2) Press operation switch (2), or use the 10-key pad to input the number (01 – 02) to select either contrast or brightness.



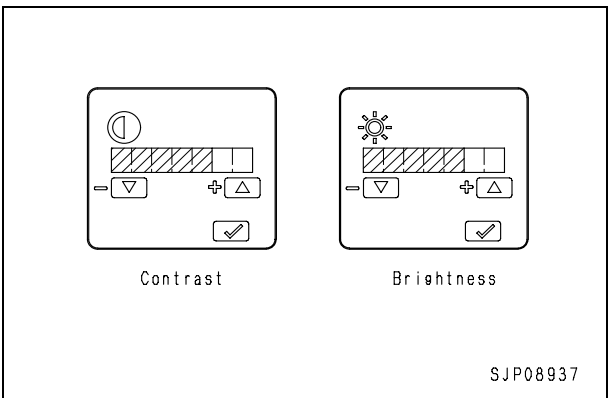
- 3) After completing the selection, press input confirmation switch (3) to return to the adjustment screen. Pressing return switch (4) without pressing input confirmation switch (3) or entering 00 with the 10-key pad and then pressing input confirmation switch (3) causes the screen to return to the normal screen.

- Relationship between menu symbol and content.

No.	Symbol	Content
00	Return mark	Return
01		Contrast
02		Brightness

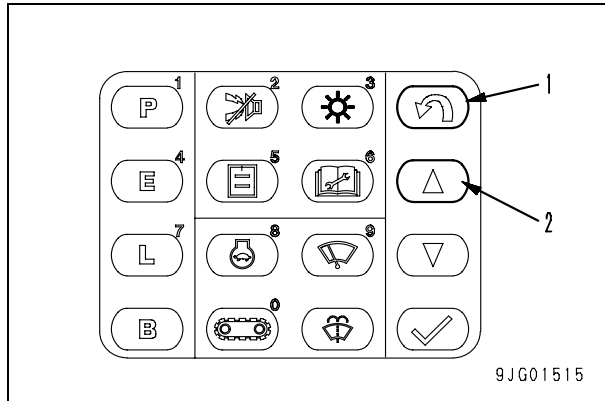
- 4) Press operation switch (2) and adjust the brightness or contrast as desired.

Control switch	Actuation
	Flow level bar graph extends to the right
	Flow level bar graph retracts to the left



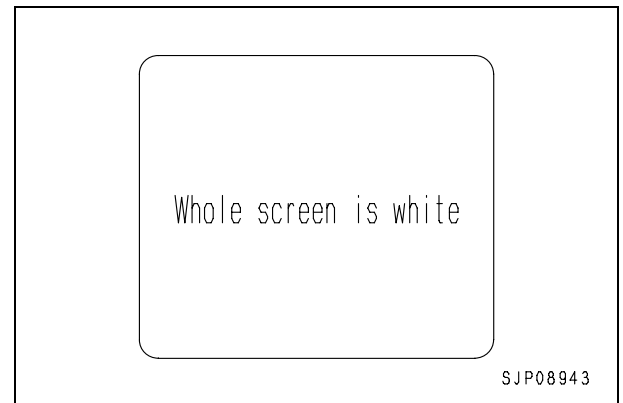
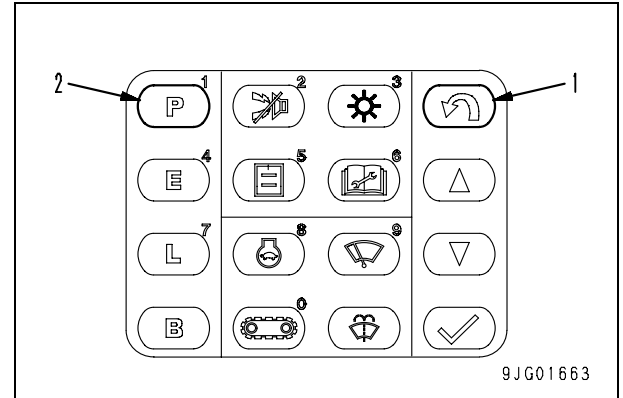
Service meter check function

- With the starting switch in the OFF position, pressing return switch (1) while holding down operation switch (2) of the monitor for 3 to 5 seconds displays the service meter.
- When the 2 switches are released, the display goes out.



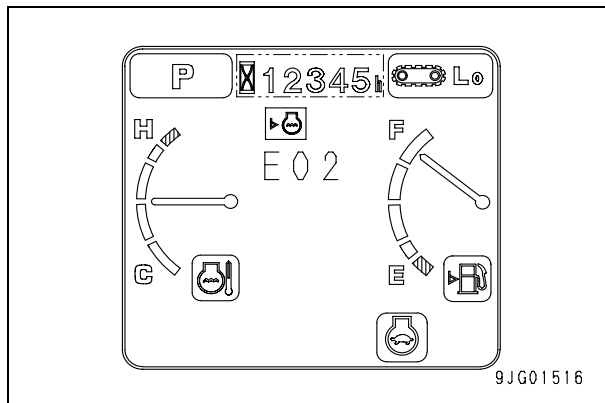
Display LCD check function

- On the normal screen, if monitor return switch (1) and working mode switch "P" (2) are kept pressed at the same time, the whole screen will become white. If any part of the display is black, the LCD is broken.

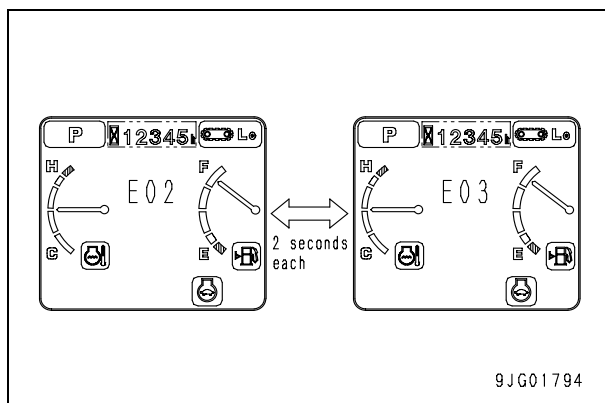


User code display function

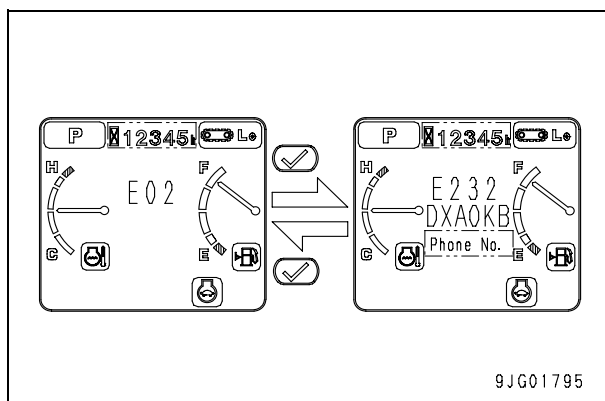
- If there is any problem in operating the machine, the user code is displayed on the monitor to advise the operator of the steps to take. This code appears on the normal screen.
- On the normal screen, the user code is displayed on the portion for the hydraulic oil temperature gauge in the centre of the screen.



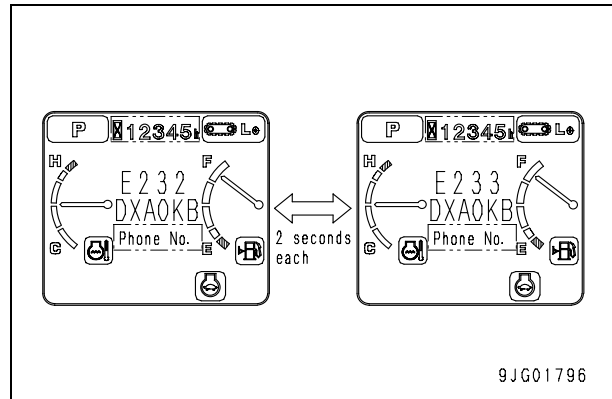
- If there are more than one user codes, they are displayed in turn every 2 seconds.



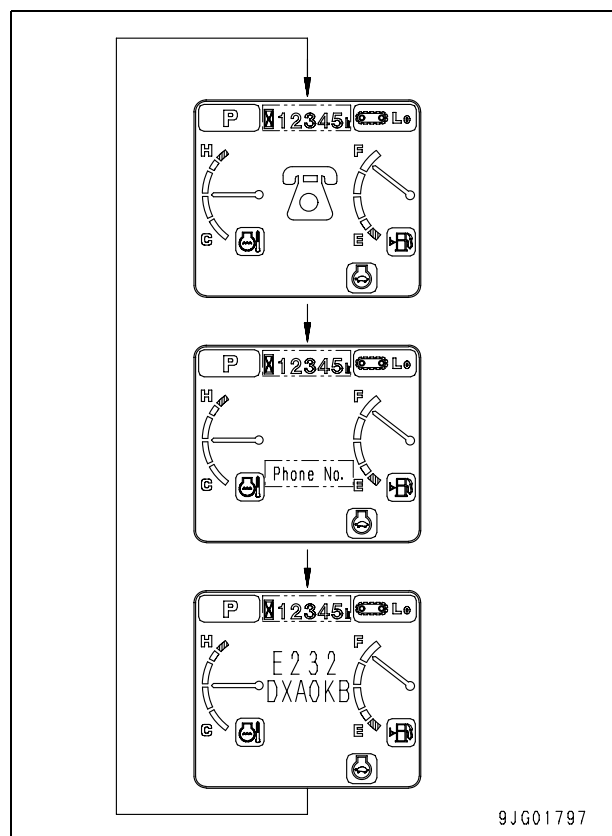
- While the user code is being displayed, if the input confirmation switch is pressed, the service code and failure code can be displayed. Both service code and failure code identify the cause of problem corresponding to the displayed user code.



- If there are more than one service or failure codes, they are displayed in turn every 2 seconds.
- Any service codes/failure codes that are not related to the displayed user code is displayed with this function.



- If the telephone number has been set using the service menu, the screen shows the service code/failure code as well as telephone symbol and telephone number. For details of inputting the telephone number, see "Special functions of machine monitor" in the "Testing and adjusting" section.

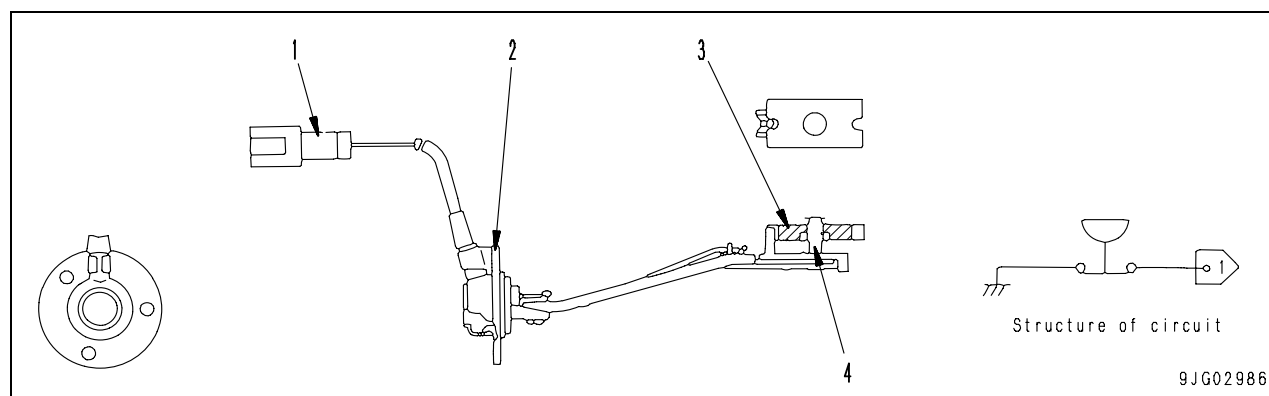


Sensor

- The signals from the sensors are input to the machine monitor directly.
- Either side of a sensor of contact type is always connected to the chassis ground.

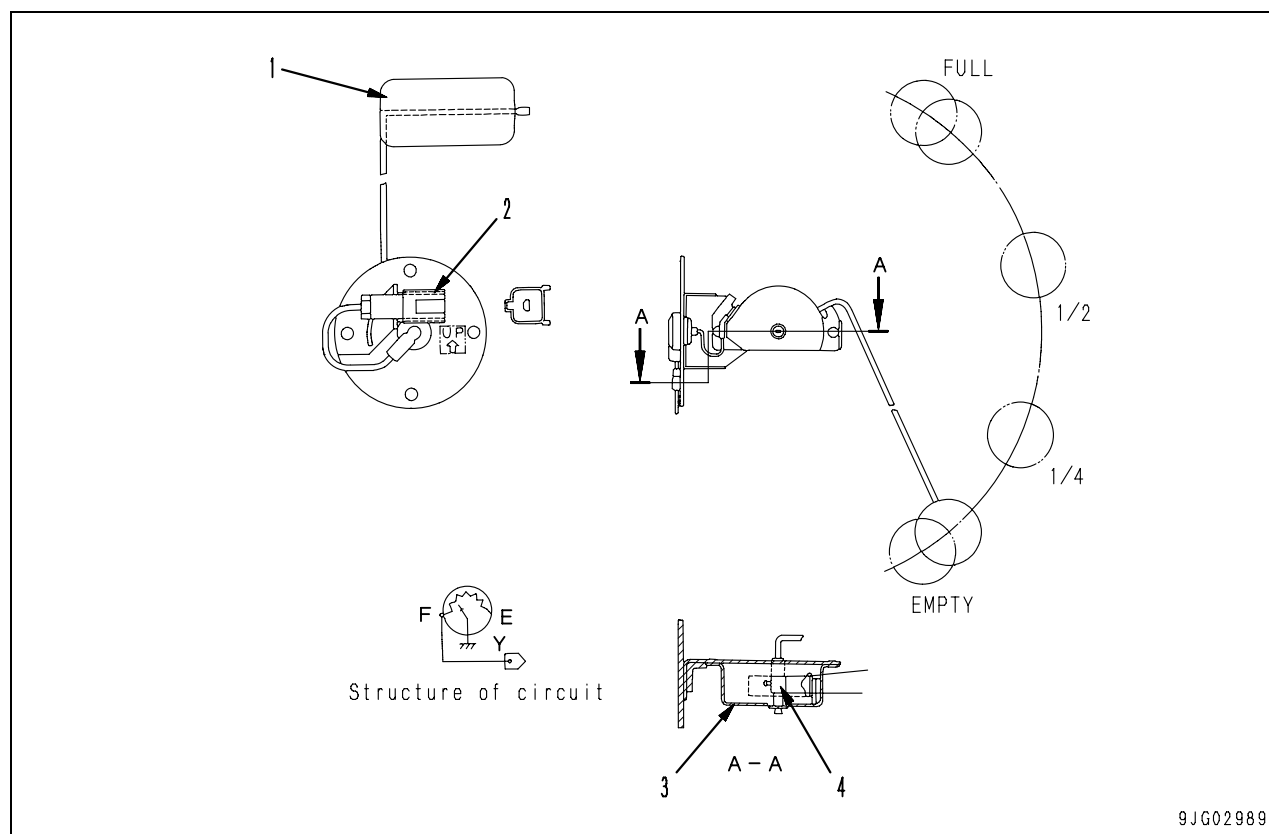
Sensor name	Type of sensor	When normal	When abnormal
Engine oil level	Contact	ON (Closed)	OFF (Open)
Fuel level	Resistance	—	—
Air cleaner clogging	Contact	OFF (Closed)	ON (Open)
Coolant level	Contact	ON (Closed)	OFF (Open)

Engine oil level sensor



1. Connector
2. Bracket
3. Float
4. Switch

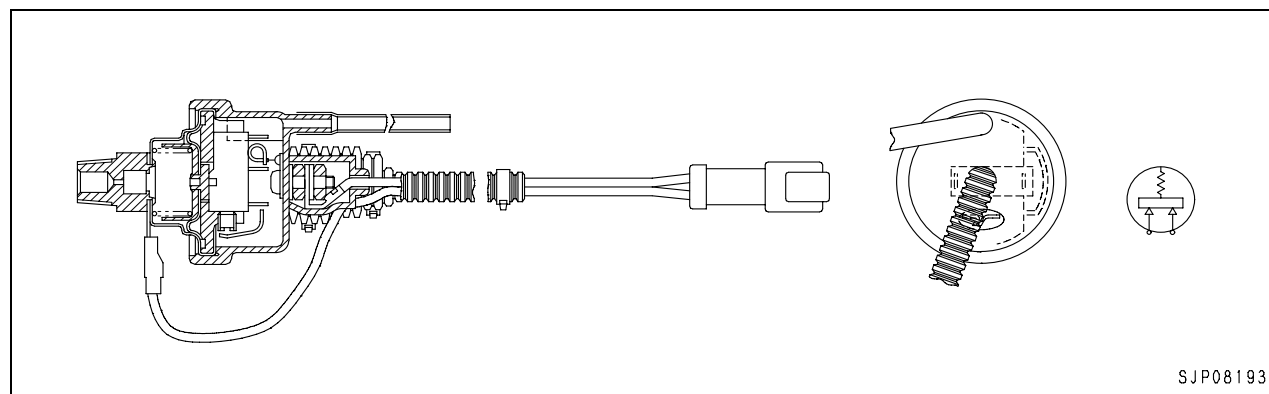
Fuel level sensor

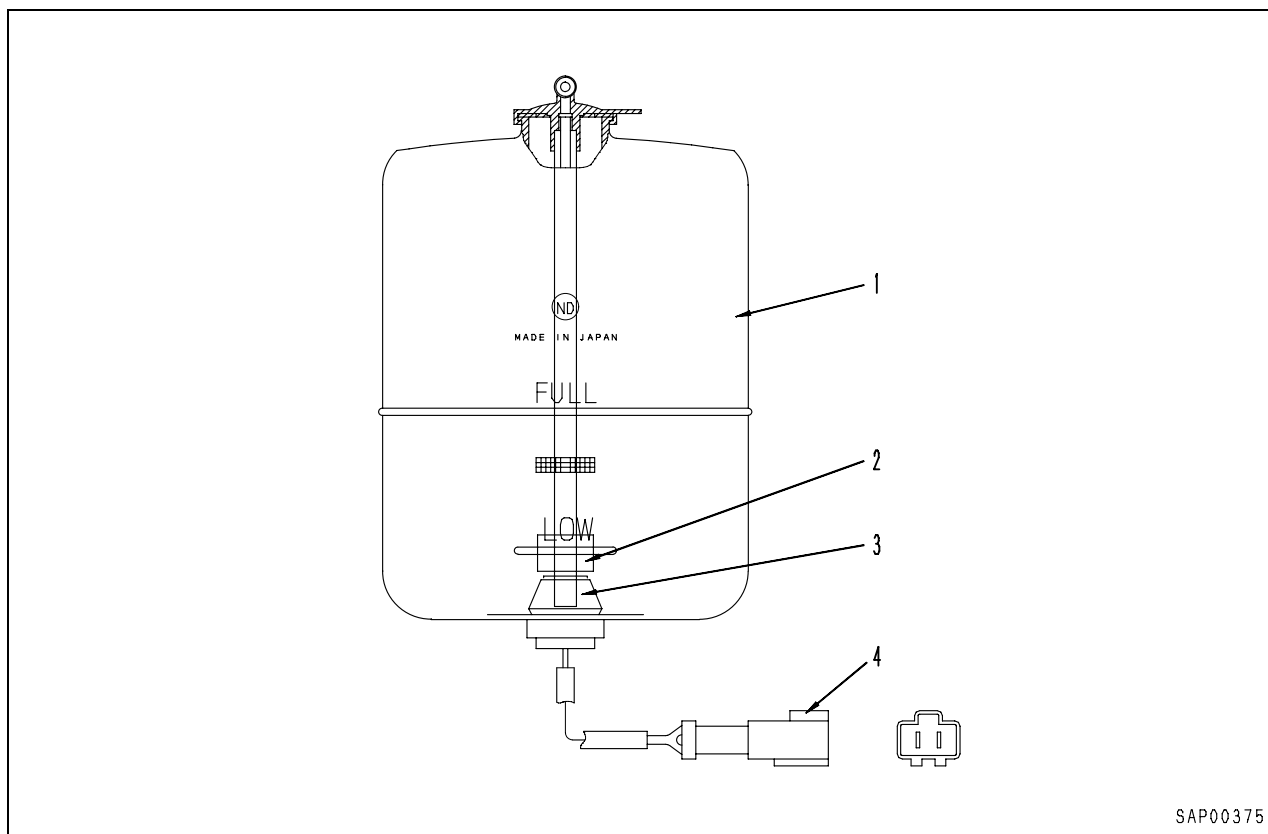


1. Float
2. Connector

3. Cover
4. Variable resistor

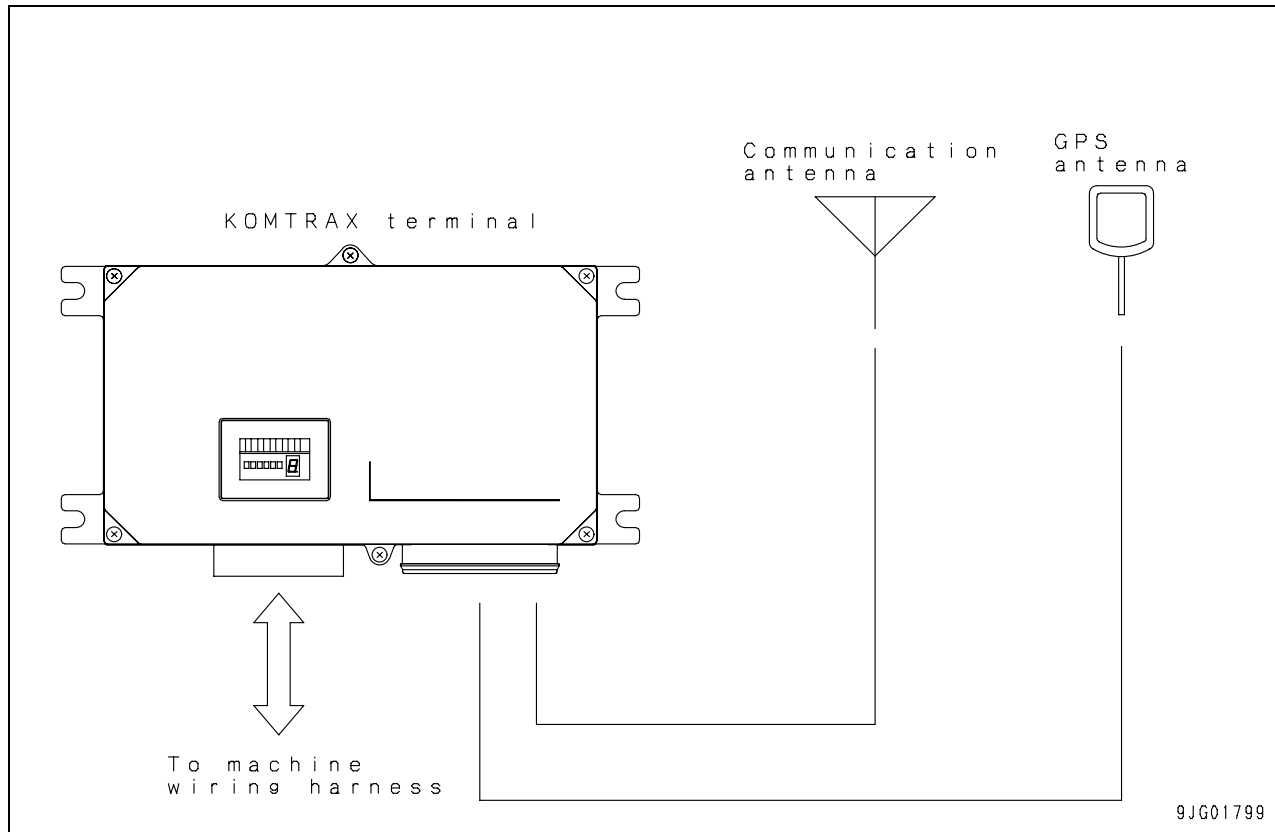
Air cleaner clogging sensor



Coolant level sensor

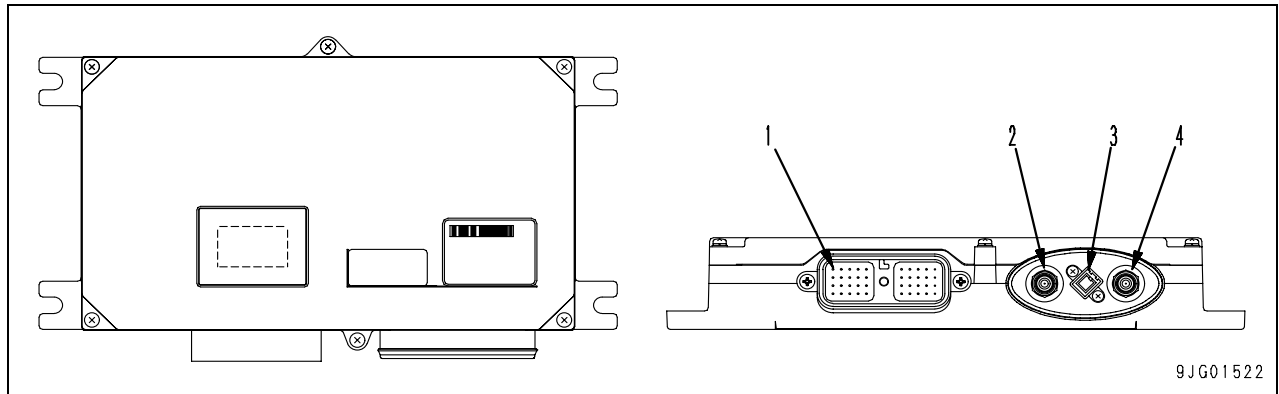
1. Reserve tank
2. Float
3. Sensor
4. Connector

KOMTRAX terminal system



- The KOMTRAX terminal system transmits various kinds of machine information wirelessly. Persons to operate the KOMTRAX can refer to the information at office to provide various kinds of services for customers.
- Information transmittable from the KOMTRAX terminal system includes the following.
 1. Operation map
 2. Service meter
 3. Position information
 4. Error history
 and others.

KOMTRAX terminal



1. DRC connector connection (40 poles)
2. (Do not connect any cable)
3. GPS antenna connection
4. Film antenna connection

- The KOMTRAX terminal obtains various kinds of machine information from the network signals and input signals in the machine and transmits them via the wireless communication antenna. It contains a CPU (Central Processing Unit) and has wireless communication function and GPS function.
- This terminal has an LED lamp unit and a 7-segment display lamp unit used for inspection and troubleshooting.

Input and output signals

DRC connector

Pin No.	Signal name	Input/output
1	NC (*)	—
2	NC (*)	—
3	NC (*)	—
4	NC (*)	—
5	NC (*)	—
6	CAN shield GND	—
7	CAN signal (L)	Input/output
8	CAN signal (H)	Input/output
9	S-NET shield GND	—
10	S-NET signal	Input/output
11	232C (0CH) shield GND	—
12	Entry signal	Input
13	232C (1CH) receiving	Input
14	232C (1CH) transmission	Output
15	NC (*)	—
16	(If equipped)	Input
17	(If equipped)	Input
18	(If equipped)	Output
19	(If equipped)	Output
20	Relay output	Output
21	Input for check	Input
22	Input for check	Input
23	NC (*)	—
24	NETWORK (1)	Input
25	NETWORK (2)	Input

*1: Never connect to NC or malfunctions or failures will occur.

DRC connector

Pin No.	Signal name	Input/output
26	(If equipped)	Input
27	C-terminal input (Hi side)	Input
28	R-terminal input	Input
29	EX GND	—
30	NC (*)	—
31	(If equipped) (5V MAX)	Input
32	(If equipped) (5V MAX)	Input
33	NC (*)	—
34	Fuel sensor	Input
35	(Reserve)	Output
36	ACC input (analog)	Input
37	Power GND	—
38	Power GND	—
39	Regular power	Input
40	Regular power	Input

*1: Never connect to NC or malfunctions or failures will occur.

PC160LC-7E0, PC180LC/NLC-7E0 Hydraulic excavator

Form No. UEN01906-00

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HYDRAULIC EXCAVATOR

PC160LC-7E0
PC180LC-7E0
PC180NLC-7E0

Machine model	Serial number
PC160LC-7E0	K45001 and up
PC180LC-7E0	K45001 and up
PC180NLC-7E0	K45001 and up

20 Standard value table

Standard service value table

Standard value table for engine	2
Standard value table for chassis related parts	3

Standard value table for engine

Applicable model					PC160LC-7E0,PC180LC/NLC-7E0	
Engine					SAA4D107E-1	
Category	Item	Measurement condition		Unit	Standard value for new machine	Judgement criteria
Engine	Engine speed	• Arm IN lever slightly operated + power maximizing	High idle	rpm	2,320 ± 70	2,320 ± 70
			Low idle	rpm	1,050 ± 50	1,050 ± 50
		• Coolant temperature: Within operating range	Rated speed	rpm	2,200	2,200
	Intake pressure (boost pressure)	• Coolant temperature: Within operating range • Arm IN relief + One-touch power Max.		kPa {mmHg}	Min. 133 {Min. 1,000}	106.7 {800}
	Exhaust gas colour	• Coolant temperature: Within operating range	At sudden acceleration	Bosch index %	Max. 25	35
			At high idle	Bosch index %	—	—
	Valve clearance	• Normal temperature	Intake valve	mm	0.25	0.152 – 0.381
			Exhaust valve	mm	0.51	0.381 – 0.762
	Compression pressure	• Oil temperature: 40 – 60°C	Compression pressure	MPa {kg/cm ² }	Min. 2.41 {Min. 24.6}	1.69 {17.2}
			Engine speed	rpm	250 – 280	250 – 280
	Blow-by pressure	• Coolant temperature: Within operating range • Arm IN relief + One-touch power max.		kPa {mmH ₂ O}	Max. 0.98 {Max. 100}	1.96 {200}
	Oil pressure	• SAE0W30E0S, SAE5W40E0S, SAE10W30DH, SAE15W40DH, SAE30DH engine oil • Coolant temperature: Within operating range	High idle	MPa {kg/cm ² }	Min. 0.29 {Min. 3.0}	0.25 {2.5}
			Low idle	MPa {kg/cm ² }	Min. 0.10 {Min. 1.0}	0.07 {0.7}
	Oil temperature	• Whole speed range (inside oil pan)		°C	80 – 110	120
	Fan belt tension	• Between fan pulley and alternator pulley • Deflection when pressed with finger force of approx. 98 N{10 kg}		mm	Auto tension	Auto tension
	Air conditioner compressor belt tension	• Between fan pulley and compressor pulley • Deflection when pressed with finger force of approx. 58.8 N{6 kg}		mm	5 – 8	5 – 8

Standard value table for chassis related parts

Applicable model					PC160LC-7E0,PC180LC/NLC-7E0	
Cate- gory	Item	Measurement condition		Unit	Standard value for new machine	Judgement criteria
Engine speed	Pump at relief	<ul style="list-style-type: none">• Engine coolant temperature: Within operating range• Hydraulic oil temperature: Within operating range• Engine at high idle• Arm OUT relief condition		rpm	2,010 ± 100	2,010 ± 100
	At pump relief + one touch power up	<ul style="list-style-type: none">• Engine coolant temperature: Within operating range• Hydraulic oil temperature: Within operating range• Engine at high idle• Arm OUT relief + One-touch power max. switch in ON condition		rpm	2,145 ± 100	2,150 ± 100
	Speed when auto- deceleration is operated	<ul style="list-style-type: none">• Engine at high idle• Auto-deceleration switch in ON condition• All control levers in NEUTRAL condition		rpm	1,400 ± 100	1,400 ± 100
Control valve Spool stroke	Boom control valve	• Engine stopped	Raise	mm	8.0 ± 0.5	8.0 ± 0.5
			Lower	mm	9.5 ± 0.5	9.5 ± 0.5
	Arm control valve		IN	mm	9.5 ± 0.5	9.5 ± 0.5
			OUT	mm	8.0 ± 0.5	8.0 ± 0.5
	Bucket control valve	• Engine stopped		mm	8.0 ± 0.5	8.0 ± 0.5
	Swing control valve			mm	7.5 ± 0.5	7.5 ± 0.5
	Travel control valve			mm	7.5 ± 0.5	7.5 ± 0.5
Travel of control levers	Boom control lever	<ul style="list-style-type: none">• Engine stopped• Control lever grip at centre• Max. reading up to stroke end (except lever play in NEUTRAL position)		mm	85 ± 10	85 ± 10
	Arm control lever			mm	85 ± 10	85 ± 10
	Bucket control lever			mm	85 ± 10	85 ± 10
	Swing control lever			mm	85 ± 10	85 ± 10
	Travel control lever			mm	115 ± 12	115 ± 12
	Play of control lever		Work equipment	mm	Max. 15	Max. 20
		Travel	mm	Max. 20	Max. 25	

Applicable model				PC160LC-7E0,PC180LC/NLC-7E0	
Category	Item	Measurement condition	Unit	Standard value for new machine	Judgement criteria
Operating force of control levers and pedal	Boom control lever	<ul style="list-style-type: none"> Hydraulic oil temperature: Within operating range Engine at high idle Control lever grip at centre Pedal at tip Max. reading up to stroke end 	N {kg}	15.7 ± 3.9 {1.6 ± 0.4}	Max. 24.5 {Max. 2.5}
	Arm control lever		N {kg}	15.7 ± 3.9 {1.6 ± 0.4}	Max. 24.5 {Max. 2.5}
	Bucket control lever		N {kg}	12.7 ± 2.9 {1.3 ± 0.3}	Max. 21.6 {Max. 2.2}
	Swing control lever		N {kg}	12.7 ± 2.9 {1.3 ± 0.3}	Max. 21.6 {Max. 2.2}
	Travel control lever		N {kg}	24.5 ± 5.9 {2.5 ± 0.6}	Max. 39.2 {Max. 4.0}
	Travel control pedal		N {kg}	74.5 ± 18.6 {7.6 ± 1.9}	Max. 107.6 {Max. 11}

Applicable model					PC160LC-7E0,PC180LC/NLC-7E0	
Category	Item	Measurement condition		Unit	Standard value for new machine	Judgement criteria
Hydraulic pressure	Unload pressure	<ul style="list-style-type: none">Hydraulic oil temperature: Within operating rangeEngine at high idleWorking mode: P modeHydraulic pump output pressure with all control levers in NEUTRAL position	When hydraulic oil temperature is about 50°C	MPa {kg/cm ² }	Max. 5.9 {Max. 60}	Max. 5.9 {Max. 60}
			When hydraulic oil temperature is about 80°C	MPa {kg/cm ² }	Max. 7.4 {Max. 75}	Max. 7.4 {Max. 75}
	Boom relief	<ul style="list-style-type: none">Hydraulic oil temperature: Within operating rangeEngine at high idleWorking mode: P modeHydraulic pump output pressure with all measurement circuits relieved	Normal relief	MPa {kg/cm ² }	34.8 ± 1.0 {355 ± 10}	33.3 – 36.8 {340 – 375}
			Power max.	MPa {kg/cm ² }	37.3 ± 1.0 {380 ± 10}	36.3 – 39.2 {370 – 400}
	Arm relief		Normal relief	MPa {kg/cm ² }	34.8 ± 1.0 {355 ± 10}	33.3 – 36.8 {340 – 375}
			Power max.	MPa {kg/cm ² }	37.3 ± 1.0 {380 ± 10}	36.3 – 39.2 {370 – 400}
	Bucket relief		Normal relief	MPa {kg/cm ² }	34.8 ± 1.0 {355 ± 10}	33.3 – 36.8 {340 – 375}
			Power max.	MPa {kg/cm ² }	37.3 ± 1.0 {380 ± 10}	36.3 – 39.2 {370 – 400}
	Swing relief	<ul style="list-style-type: none">Hydraulic oil temperature: Within operating rangeEngine at high idleWorking mode: P mode	MPa {kg/cm ² }	30.9 ± 1.5 {315 ± 15}	28.9 – 32.9 {295 – 335}	
	Travel relief	<ul style="list-style-type: none">Hydraulic pump output pressure with all measurement circuits relieved	MPa {kg/cm ² }	37.3 ± 1.0 {380 ± 10}	36.3– 39.2 {370 – 400}	
	Control circuit source pressure	<ul style="list-style-type: none">Hydraulic oil temperature: Within operating rangeEngine running at high idleSelf pressure reducing valve output pressure with all control levers in NEUTRAL position	MPa {kg/cm ² }	3.23 ± 0.2 {33 ± 2}	2.84– 3.43 {29 – 35}	
	LS differential pressure	<ul style="list-style-type: none">Hydraulic oil temperature: Within operating rangeEngine at high idleWorking mode: P modeHydraulic oil pump pressure – LS pressure	When all control levers in NEUTRAL position	MPa {kg/cm ² }	4.5 ± 1.0 {46 ± 10}	4.5 ± 1.0 {46 ± 10}
			While bucket is digging (Full)	MPa {kg/cm ² }	2.2 ± 0.1 {22.5 ± 1}	2.2 ± 0.1 {22.5 ± 1}

Applicable model					PC160LC-7E0,PC180LC/NLC-7E0	
Category	Item	Measurement condition		Unit	Standard value for new machine	Judgement criteria
Swing	Swing brake angle	<ul style="list-style-type: none">Hydraulic oil temperature: Within operating rangeEngine running at high idleWorking mode: P modeSwing circle misalignment amount when stopping after one turnFor measuring posture, see Swing 1		deg. (mm)	Max. 100 (—)	Max. 130 (—)
	Time taken to start swing	<ul style="list-style-type: none">Hydraulic oil temperature: Within operating rangeEngine running at high idleWorking mode: P mode	90°	sec.	3.0 ± 0.3	Max. 3.7
		<ul style="list-style-type: none">Time required for passing points 90° and 180° from starting pointFor measuring posture, see Swing 1	180°	sec.	4.2 ± 0.4	Max. 5.5
	Time taken to swing	<ul style="list-style-type: none">Hydraulic oil temperature: Within operating rangeEngine running at high idleWorking mode: P modeTime required for 5 more turns after making initial one turnFor measuring posture, see Swing 1		sec.	25 ± 2.5	Max. 30
	Hydraulic drift of swing	<ul style="list-style-type: none">Hydraulic oil temperature: Within operating rangeKeeping upper structure transverse on slope of 15°Engine stoppedNotching a mating mark on inner and outer races of swing circleMating mark misalignment amount during 5 minutesFor measuring posture, see Swing 2		mm	0	0
	Leakage from swing motor	<ul style="list-style-type: none">Hydraulic oil temperature: Within operating rangeEngine running at high idleSwing lock switch: ONLeakage amount for one minute during swing relief		ℓ/min	Max. 5	Max. 10
Travel	Travel speed (without load)	<ul style="list-style-type: none">Hydraulic oil temperature: Within operating rangeEngine running at high idleWorking mode: P mode	Lo	sec.	44.3 ± 4.4	39.9 – 50.7
		<ul style="list-style-type: none">Time required for track shoes to make 5 turns after making one initial idle turnFor measuring posture, see Travel 1	Hi		27.4 ± 1.4	26.0 – 30.8

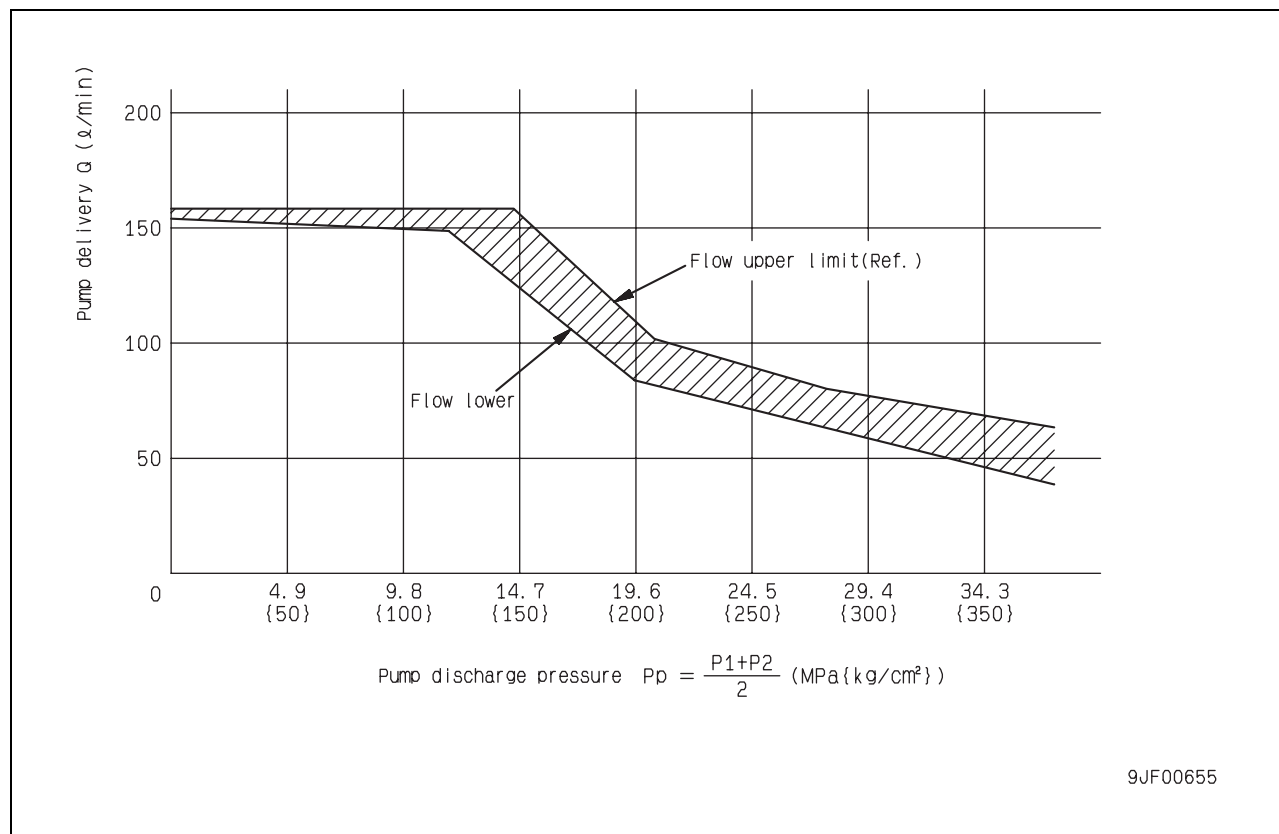
Applicable model					PC160LC-7E0, PC180LC/NLC-7E0	
Category	Item	Measurement condition		Unit	Standard value for new machine	Judgement criteria
Travel	Travel speed (actual run)	<ul style="list-style-type: none"> Hydraulic oil temperature: Within operating range Engine running at high idle Working mode: P mode Solid and flat ground Time required for travelling 20 m after 10 m trial run For measuring posture, see Travel 2 	Lo	sec.	21 ± 2.5	21.5 – 27.5
			Hi	sec.	13 ± 1.0	12.0 – 15.0
	Travel deviation	<ul style="list-style-type: none"> Hydraulic oil temperature: Within operating range Engine at high idle Working mode: P mode Travel speed: Lo Solid and flat ground Swerving amount while travelling 20 m after initial 10 m trial run For measuring posture, see Travel 2 and 3 		mm	Max. 150	Max. 250
	Hydraulic drift of travel	<ul style="list-style-type: none"> Hydraulic oil temperature: Within operating range Parking machine on slope of 12° with sprocket facing upslope Engine stopped Sliding distance for 5 minutes For measuring posture, see Travel 4 		mm	0	0
	Leakage of travel motor	<ul style="list-style-type: none"> Hydraulic oil temperature: Within operating range Engine at high idle Travelling with sprocket locked Oil leakage amount for one minute with travelling in relief condition 		ℓ/min	13.6	27.2
Work equipment	Hydraulic drift of work equipment	<ul style="list-style-type: none"> Hydraulic oil temperature: Within operating range Flat and level ground Fill bucket with dirt or rated load (1,080kg) Boom horizontal, arm fully retracted, bucket cylinder fully extended Engine stopped Work equipment control lever in NEUTRAL position Fall amount for 15 minutes as measured every 5 minutes starting immediately after initial setting Whole work equipment: Lowering distance of tooth tip Boom cylinder: Retraction distance of cylinder Arm cylinder: Extraction distance of cylinder Bucket cylinder: Retraction distance of cylinder For measuring posture, see Work equipment 1 		mm	Max. 600	Max. 900
				mm	Max. 18	Max. 27
				mm	Max. 160	Max. 240
				mm	Max. 40	Max. 58

Applicable model					PC160LC-7E0,PC180LC/NLC-7E0	
Category	Item	Measurement condition	Unit		Standard value for new machine	Judgement criteria
Work equipment	Boom	<ul style="list-style-type: none"> Hydraulic oil temperature: Within operating range Engine running at high idle Working mode: P mode Time required from raise stroke end till bucket touches ground (Raise until cushion starts operates for raising stroke). For measuring posture, see Work equipment 2 	RAISE	sec.	3.5 ± 0.4	Max. 4.9
			LOWER	sec.	2.4 ± 0.3	Max. 3.7
	Arm	<ul style="list-style-type: none"> Hydraulic oil temperature: Within operating range Engine running at high idle Working mode: P mode Time required from dumping stroke end to digging stroke end (between starting points of cushion). For measuring posture, see Work equipment 3 	IN	sec.	$3.3+0.4/-0.2$	Max. 4.5
			OUT	sec.	2.8 ± 0.3	Max. 3.5
	Bucket	<ul style="list-style-type: none"> Hydraulic oil temperature: Within operating range Engine running at high idle Working mode: P mode Time required from dumping stroke end to digging stroke end For measuring posture, see Work equipment 4 	CURL	sec.	2.6 ± 0.3	Max. 3.5
			DUMP	sec.	2.2 ± 0.2	Max. 3.0

Applicable model				PC160LC-7E0,PC180LC/NLC-7E0	
Category	Item	Measurement condition	Unit	Standard value for new machine	Judgement criteria
Work equipment	Time lag	Boom	sec.	Max. 1.0	Max. 1.2
		Arm	sec.	Max. 3.0	Max. 4.2
		Bucket	sec.	Max. 1.0	Max. 3.6
	Internal leakage	Cylinders	cc/min	4.5	20
		Centre swivel joint	cc/min	10	50
Performance in compound operation	Swerving amount in simultaneous operation of work equipment and travel	<ul style="list-style-type: none"> Hydraulic oil temperature: Within operating range Engine at high idle Working mode: P mode Travelling speed: Lo Ground: Hard and level Measure travel deviation in travel of 20 m after running up 10 m. For measuring posture, see Travel 2 and 3 	mm	Max.200	Max.220
—	Discharge amount of hydraulic pump	See performance of hydraulic pump (next page)			

Applicable model				PC160LC-7E0,PC180LC/NLC-7E0	
Category	Item	Measurement condition	Unit	Standard value for new machine	Judgement criteria
Characteristics of PC flow control valve	Time required for turning from 0 to 90° with boom raised	<ul style="list-style-type: none"> Hydraulic oil temperature: Within operating range Engine at high idle Working mode: P mode Rated load applied to bucket Ground: Hard and level Set arm vertically and lower back of bucket to ground. Time required till passing spot of 90° starting from illustrated posture and with boom raised For measuring posture, see Compound 1 	sec.	4.0 ± 0.4 (Reference value)	

Discharge amount of hydraulic pump



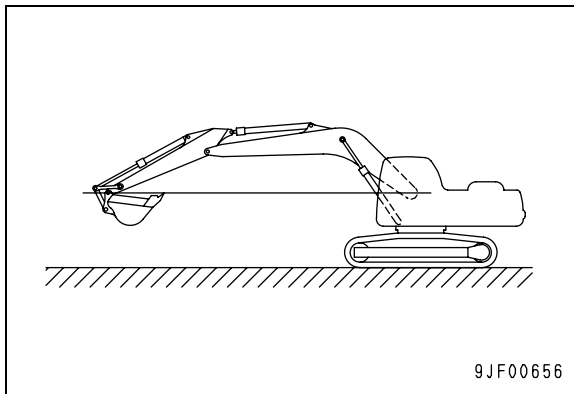
- Pump speed: At 2,200 rpm, PC-EPC current 350 mA

Check point	Test pump discharge pressure (MPa {kg/cm ² })	Discharge pressure of other pump (MPa {kg/cm ² })	Average pressure (MPa {kg/cm ² })	Standard value for discharge amount Q (ℓ/min)	Judgement standard lower limit Q (ℓ/min)
As desired	P1	P2	$PP = \frac{P_1 + P_2}{2}$	See graph	See graph

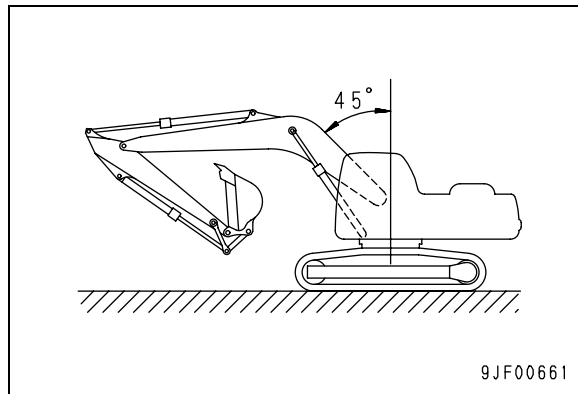
- ★ As far as possible, bring pump discharge pressure P1 and P2 as close as possible to the average pressure when measuring.
- ★ The error is large near the point where the graph curves, so avoid measuring at this point.
- ★ When measuring with the pump mounted on the machine, if it is impossible to set the engine speed to the specified speed with the fuel control dial, take the pump discharge amount and the engine speed at the point of measurement, and use them as a base for calculating the pump discharge amount at the specified speed.

Posture of machine for measuring performance and measuring method

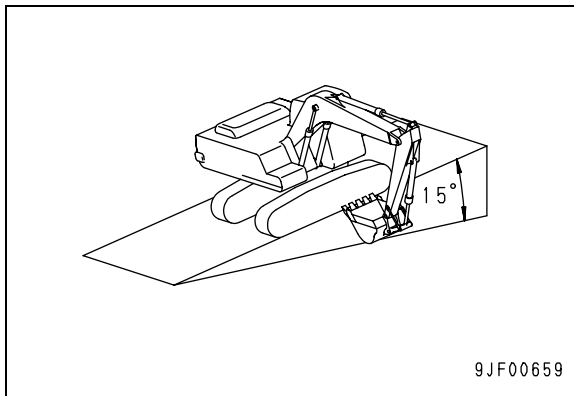
Swing 1: Swing brake angle, time taken to start swing, time taken to swing



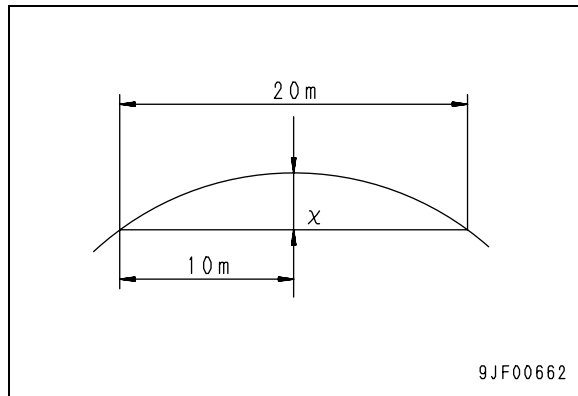
Travel 2: Travel speed (actual run), travel deviation



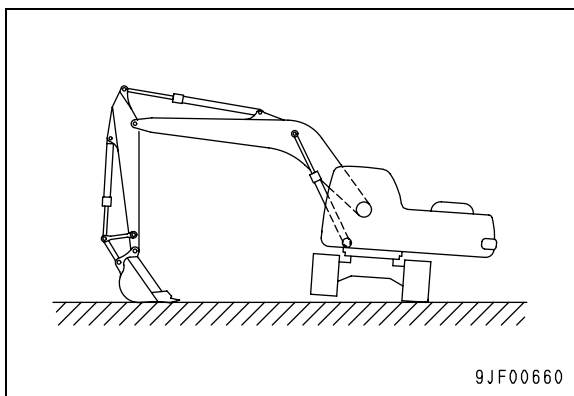
Swing 2: Hydraulic drift of swing



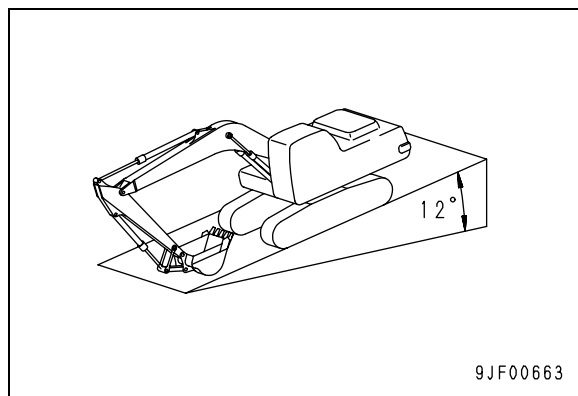
Travel 3: Travel deviation

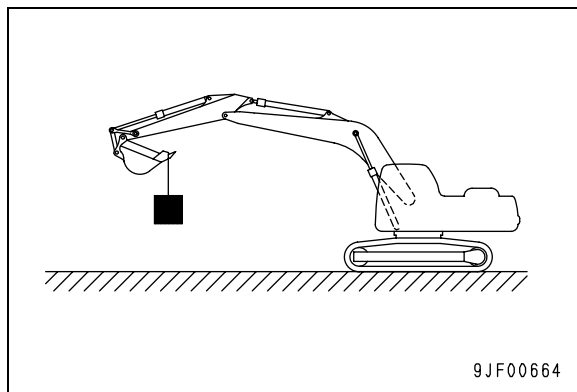
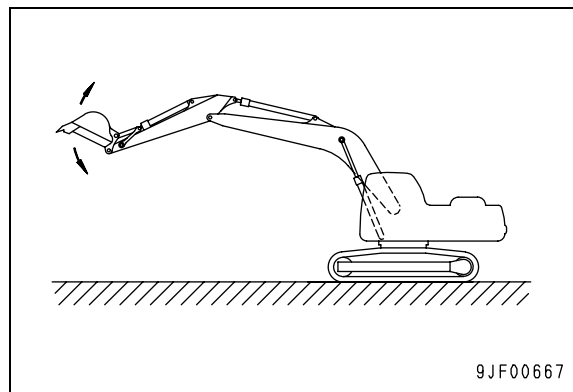
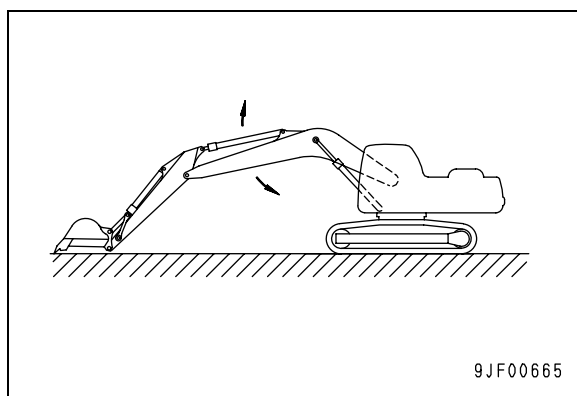
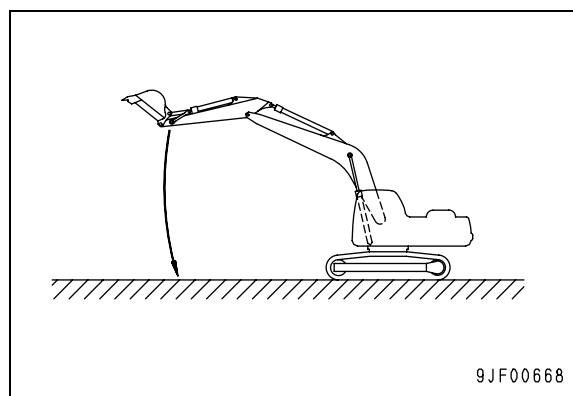
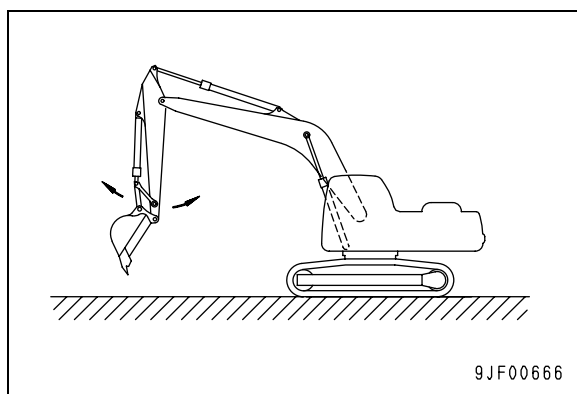
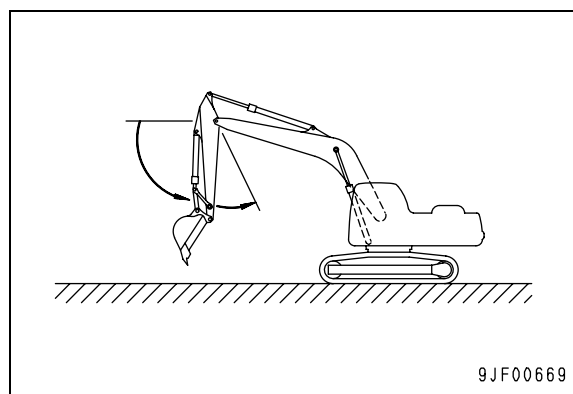


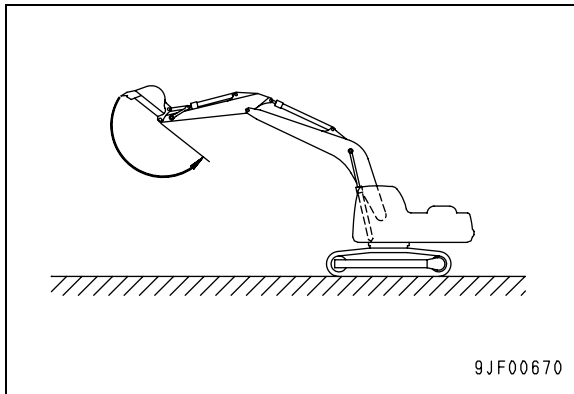
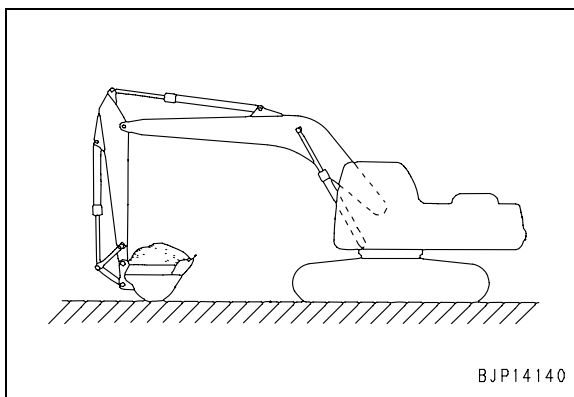
Travel 1: Travel speed (without load)



Travel 4: Hydraulic drift of travel



Work equipment 1: Hydraulic drift of work equipment**Work equipment 4:** Bucket speed**Work equipment 2:** Boom speed**Work equipment 5:** Boom time lag**Work equipment 3:** Arm speed**Work equipment 6:** Arm time lag

Work equipment 7: Bucket time lag**Compound 1: Performance in compound operation**

PC160LC-7E0, PC180LC/NLC-7E0 Hydraulic excavator

Form No. UEN02107-00

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HYDRAULIC EXCAVATOR

PC160LC-7E0

PC180LC-7E0

PC180NLC-7E0

Machine model Serial number

PC160LC-7E0	K45001 and up
PC180LC-7E0	K45001 and up
PC180NLC-7E0	K45001 and up

30 Testing and adjusting

Testing and adjusting, Part 1

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Tools for testing, adjusting, and troubleshooting

Testing/Adjusting item	Sym- bol	Part No.	Part name	Qty	Remarks
Measuring intake air pressure (boost pressure)	A	799-201-2202	Boost gauge kit	1	−101 – 200 kPa {−760 – 1,500 mmHg}
Checking exhaust gas colour	B	1 799-201-9001	Handy smoke checker	1	Bosch index: 0 – 9
		2 Commercially available	Smoke meter	1	
Adjusting valve clearance	C	1 795-799-1131	Gear	1	Intake: 0.25 mm, Exhaust: 0.51 mm
		2 Commercially available	Clearance gauge	1	
Measuring compression pressure	D	1 795-502-1590	Compression gauge	1	0 – 6.9 MPa {0 – 70 kg/cm ² }
		2 795-799-6700	Puller	1	For 107E-1 engine
		3 795-790-4410	Adapter	1	For 107E-1 engine
		6754-11-3130	Gasket	1	For 107E-1 engine
Measuring blow-by pressure	E	1 799-201-1504	Blow-by checker	1	0 – 5 kPa {0 – 500 mmH ₂ O}
		2 795-790-3300	Blow-by tool	1	For 107E-1 engine
Measuring engine oil pressure	F	1 799-101-5002	Hydraulic tester	1	Pressure gauge: 2.5, 5.9, 39.2, 58.8 MPa {25, 60, 400, 600 kg/cm ² }
		790-261-1204	Digital hydraulic tester	1	Pressure gauge: 58.8 MPa {600 kg/cm ² }
		2 799-401-2320	Hydraulic tester	1	Pressure gauge: 0.98 MPa {10 kg/cm ² }
Measuring fuel pressure	G	1 799-101-5002	Hydraulic tester	1	Pressure gauge: 2.5, 5.9, 39.2, 58.8 MPa {25, 60, 400, 600 kg/cm ² }
		790-261-1204	Digital hydraulic tester	1	Pressure gauge: 58.8 MPa {600 kg/cm ² }
		2 795-790-4430	Adapter	1	10 × 1.0 mm → R1/8
		6215-81-9710	O-ring	1	
		3 795-790-5200	Fuel pressure gauge adapter kit	1	Cu 4918462
Measuring fuel discharge, return rate and leakage	H	4 799-401-2320	Hydraulic tester	1	Pressure gauge: 0.98 MPa {10 kg/cm ² }
		1 Commercially available	Hose	1	Internal dimensions ø14 mm
		2 795-790-4700	Tester kit	1	
		3 795-790-6700	Adapter	1	
		4 6754-71-5340	Connector	1	
		6754-71-5350	Washer	1	
		5 Commercially available	Measuring cylinder	1	
Measuring swing circle bearing clearance	J	6 Commercially available	Stopwatch	1	
		7 Commercially available	Hose	1	Internal dimensions ø12 mm
Measuring and adjusting oil pressure in work equipment, swing, and travel circuits	K	1 799-101-5002	Hydraulic tester	1	Pressure gauge: 2.5, 5.9, 39.2, 58.8 MPa {25, 60, 400, 600 kg/cm ² }
		790-261-1204	Digital hydraulic tester	1	Pressure gauge: 58.8 MPa {600 kg/cm ² }
		2 799-101-5220	Nipple	2	Size: 10 × 1.25 mm
		07002-11023	O-ring	2	

Testing/Adjusting item	Sym- bol	Part No.	Part name	Qty	Remarks
Measuring basic pressure of control circuit	L	799-101-5002	Hydraulic tester	1	Pressure gauge: 2.5, 5.9, 39.2, 58.8 MPa {25, 60, 400, 600 kg/cm ² }
		790-261-1204	Digital hydraulic tester	1	Pressure gauge: 58.8 MPa {600 kg/cm ² }
		799-101-5220	Nipple	1	Size: 10 × 1.25 mm
		07002-11023	O-ring	1	
Measuring and adjusting oil pressure in pump PC control circuit	M	799-101-5002	Hydraulic tester	1	Pressure gauge: 2.5, 5.9, 39.2, 58.8 MPa {25, 60, 400, 600 kg/cm ² }
		790-261-1204	Digital hydraulic tester	1	Pressure gauge: 58.8 MPa {600 kg/cm ² }
		799-101-5220	Nipple	4	Size: 10 × 1.25 mm
		07002-11023	O-ring	4	
Measuring and adjusting oil pressure in pump LS control circuit	N	799-101-5002	Hydraulic tester	1	Pressure gauge: 2.5, 5.9, 39.2, 58.8 MPa {25, 60, 400, 600 kg/cm ² }
		790-261-1204	Digital hydraulic tester	1	Pressure gauge: 58.8 MPa {600 kg/cm ² }
		799-101-5220	Nipple	4	Size: 10 × 1.25 mm
		07002-11023	O-ring	4	
		799-401-2701	Differential pressure gauge	1	49 MPa {500 kg/cm ² }
Measuring solenoid valve output pressure	P	799-101-5002	Hydraulic tester	1	Pressure gauge: 2.5, 5.9, 39.2, 58.8 MPa {25, 60, 400, 600 kg/cm ² }
		790-261-1204	Digital hydraulic tester	1	Pressure gauge: 58.8 MPa {600 kg/cm ² }
		799-401-3100	Adapter	1	Size: 02
		799-401-3200	Adapter	1	Size: 03
Measuring PPC valve out-put pressure	Q	799-101-5002	Hydraulic tester	1	Pressure gauge: 2.5, 5.9, 39.2, 58.8 MPa {25, 60, 400, 600 kg/cm ² }
		790-261-1204	Digital hydraulic tester	1	Pressure gauge: 58.8 MPa {600 kg/cm ² }
Measuring oil leakage	R	Commercially available	Measuring cylinder	1	
Measuring coolant temperature and oil temperature	—	799-101-1502	Digital thermometer	1	– 99.9 – 1,299°C
Measuring operating effort and depressing force	—	79A-264-0021	Push-pull scale	1	0 – 294 N {0 – 30 kg}
		79A-264-0091	Push-pull scale	1	0 – 490 N {0 – 50 kg}
Measuring stroke and hydraulic drift	—	Commercially available	Ruler	1	
Measuring work equipment speed	—	Commercially available	Stopwatch	1	
Measuring voltage and resistance	—	Commercially available	Circuit tester	1	
Removal and installation of boost pressure and temperature sensors	—	Commercially available	Torque wrench	1	3.26 mm torque wrench (KTC Q4T15 or equivalent)
Removal and installation of engine oil pressure sensor	—	795-799-6210	Deep socket	1	27 mm deep socket

Testing/Adjusting item	Sym- bol	Part No.	Part name	Qty	Remarks
Removal and installation of engine coolant temperature sensor	—	Commercially available	Socket	1	21 mm deep socket (MITOLOY 4ML-21 or equivalent)
Diagnosis of sensor and harness	—	799-601-7400	T-adapter assembly	1	AMP040 connector
		799-601-7500	T-adapter assembly	1	AMP070 connector
		799-601-9000	T-adapter assembly	1	DT, HD30 connector
		799-601-9300	T-adapter assembly	1	DRC26-24, 40-pin
		799-601-7360	Adapter	1	Relay (5-pin)
		799-601-7310	T-adapter	1	SWP (12-pin)
		799-601-7070	T-adapter	1	SWP (16-pin)
		799-601-4100	T-adapter assembly	1	Engine-related connector
		795-799-5530	• T-adapter	1	Engine coolant temperature
		799-601-4230	• T-adapter	1	Boost temperature sensor/pressure sensor
		799-601-4130	• T-adapter	1	Ne sensor, CAM sensor
		799-601-4160	• T-adapter	1	Oil pressure sensor
		799-601-4211	• T-adapter	1	Controller (50-pole)
		799-601-4220	• T-adapter	1	Controller (60-pole)
		799-601-4140	• T-adapter	1	Ambient pressure sensor
		799-601-4340	• T-adapter	1	Pump actuator
		799-601-4260	• T-adapter	1	Controller (4-pole)
		799-601-4190	• T-adapter	1	Common rail pressure sensor

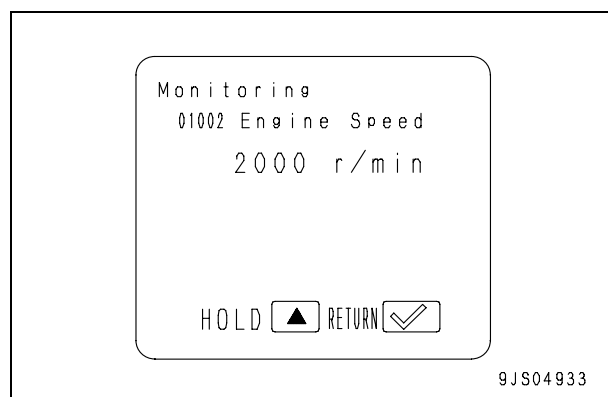
Measuring engine speed

- ★ Measure the engine speed with the monitoring function of the machine monitor.
- ★ Measure the engine speed under the following condition.
 - Engine coolant temperature: Within operating range
 - Hydraulic oil temperature: Within operating range

1. Preparation work

Operate the machine monitor so that the engine speed can be monitored.

- ★ For the operating method of the machine monitor, see "Special functions of machine monitor".
- ★ Monitoring code: 01002 Engine speed



2. Measuring low idle speed

- 1) Start the engine and set the fuel control dial to the low idle (MIN) position.
- 2) Set all the control levers and pedals for work equipment, swing and travel to the neutral and measure the engine speed.

3. Measuring high idle speed

- 1) Start the engine and set the fuel control dial to the high idle (MAX) position.
- 2) Set the working mode in the power mode (P) and turn the auto-decelerator OFF.
- 3) While operating the left work equipment control lever to move the arm slightly at the IN stroke end by avoiding overload on the arm, and depressing the power maximizing switch, measure the engine speed.
 - ★ The power maximizing function is reset automatically in about 8.5 seconds even if the switch is being depressed. Thus measurement of the engine speed must be completed within that period.

4. Measuring the engine speed when pump is relieved

- 1) Start the engine and set the arm cylinder to the dump stroke end.
- 2) Set the fuel control dial in the high idle (MAX) position and set the working mode in the power mode (P).
- 3) Operate the left work equipment control lever to relieve the arm circuit at the dump stroke end and measure the engine speed.

5. Measuring the engine speed at pump relief and power maximizing (near rated speed)

- 1) Start the engine and set the arm cylinder to the dump stroke end.
- 2) Set the fuel control dial in the high idle (MAX) position and set the working mode in the power mode (P).
- 3) While operating the left work equipment control lever to relieve the arm at the dump stroke end and depressing the power maximizing switch, measure the engine speed.
 - ★ The power maximizing function is reset automatically in about 8.5 seconds even if the switch is being depressed. Thus measurement of the engine speed must be completed within that period.

6. Measuring the speed when auto-deceleration speed is in operation

- 1) Start the engine, set the fuel control dial in the high idle position (MAX), and turn the auto-decelerator ON.
- 2) Set all the control levers and pedals for work equipment, swing and travel to neutral and measure the engine speed when the auto-decelerator is operated.
 - ★ The engine speed is slowed down to a certain level in about 5 seconds from setting all the control levers and pedals to the neutral. This level is the engine speed when operation of the auto-deceleration is turned on.

Measuring intake air pressure (boost pressure)

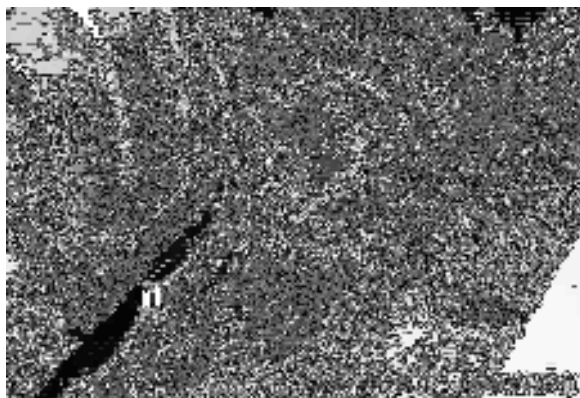
- ★ Measuring tools for intake air pressure (boost pressure)

Symbol	Part No.	Part name
A	799-201-2202	Boost gauge kit

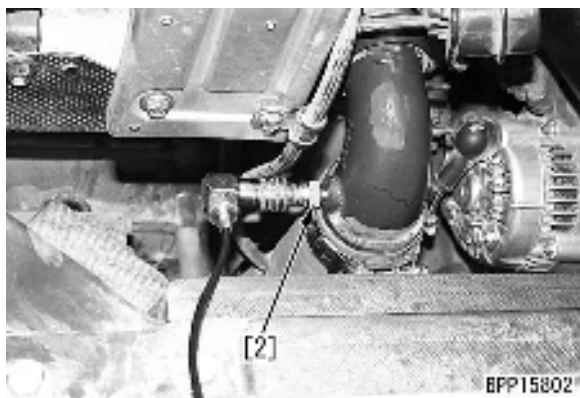
⚠ Stop the machine on a level ground and lower the work equipment to the ground.

- ★ Measure the intake air pressure under the following condition.
 - Engine coolant temperature: Within operating range
 - Hydraulic oil temperature: Within operating range

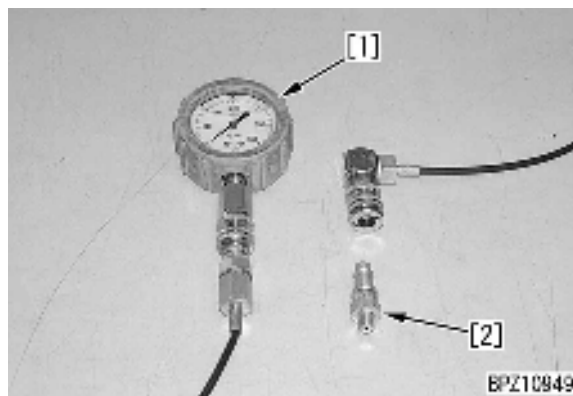
1. Open the engine hood and remove intake air pressure pickup plug (1) (R1/8) from the intake air connector.



2. Install nipple [2] of boost gauge kit A and connect it to gauge [1].



3. Run the engine at middle or higher speed and bleed oil from the hose.
 - ★ Insert the connecting parts of the gauge and hose about a half and open the self-seal on the hose side repeatedly, and the oil will be drained.
 - ★ If Pm kit (A) is available, you use the air-bleeding coupling (790-261-1130) in that kit.
 - ★ If oil is left in the hose, the gauge does not work. Accordingly, be sure to drain the oil.
4. Set the working mode in the power mode (P) and turn the swing lock switch ON.
 - ★ If the swing lock switch is turned ON, the main relief valve is set for high-pressure relief.
5. While running the engine at high idle, relieve the arm circuit at the IN and measure the intake air pressure.



6. After finishing measurement, remove the measuring tools and return the removed parts.

Checking exhaust gas colour

- ★ Checking tools for exhaust gas colour

Symbol	Part No.	Part name
B	1	799-201-9001 Handy smoke checker
	2	Commercially available Smoke meter

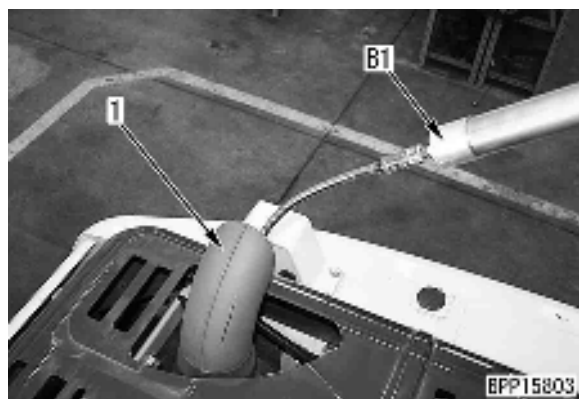
⚠ **Stop the machine on a level ground and lower the work equipment to the ground.**

⚠ **Be careful not to touch any hot part when removing or installing the checking tools.**

- ★ Check the exhaust gas colour under the following condition.
- Engine coolant temperature: Within operating range
- ★ If an air source and an electric power source are not available in the field, use handy smoke checker **B1**. When recording official data, use smoke meter **B2**.

1. Measuring with handy smoke checker B1

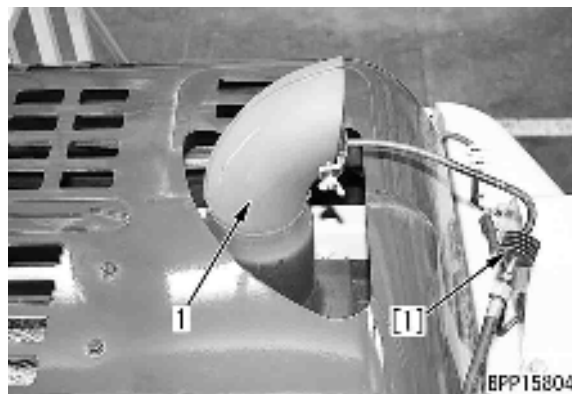
- 1) Stick a sheet of filter paper to smoke checker **B1**.
- 2) Insert the exhaust gas intake pipe in exhaust pipe (1).
- 3) Start the engine and accelerate it suddenly or run it at high idle and operate the handle of smoke checker **B1** so that the filter paper will absorb the exhaust gas.
 - ★ Absorbing time: 1.4 ± 0.2 sec



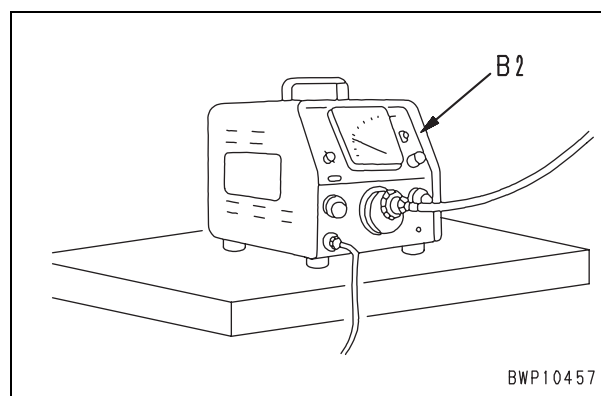
- 4) Remove the filter paper and compare it with the attached scale.
- 5) After finishing checking, remove the measuring tools and return the removed parts.

2. Checking with smoke meter B2

- 1) Insert probe [1] of smoke meter **B2** in the outlet of the exhaust pipe and fix it to the exhaust pipe with a clip.



- 2) Connect the probe hose, receptacle of the accelerator switch, and air hose to smoke meter **B2**.
 - ★ Limit the supplied air pressure to 1.5 MPa {15 kg/cm²}.
- 3) Connect the power cable to an AC 100 V receptacle.
 - ★ Before connecting the cable, check that the power switch of the smoke meter is turned OFF.
- 4) Loosen the cap nut of the suction pump and fit the filter paper.
 - ★ Fit the filter paper securely so that the exhaust gas will not leak.
- 5) Turn on the power switch of smoke meter **B2**.



- 6) Start the engine and accelerate it suddenly or run it at high idle and depress the accelerator pedal of smoke meter **B2** and collect the exhaust gas into the filter paper.
- 7) Place the contaminated filter paper on the clean filter paper (at least 10 sheets) in the filter paper holder and read the indicated value.
- 8) After finishing checking, remove the checking tools and return the removed parts.

Adjusting valve clearance

- ★ Measuring tools for valve clearance

Symbol		Part No.	Part name
C	1	795-799-1131	Gear
	2	Commercially available	Clearance gauge

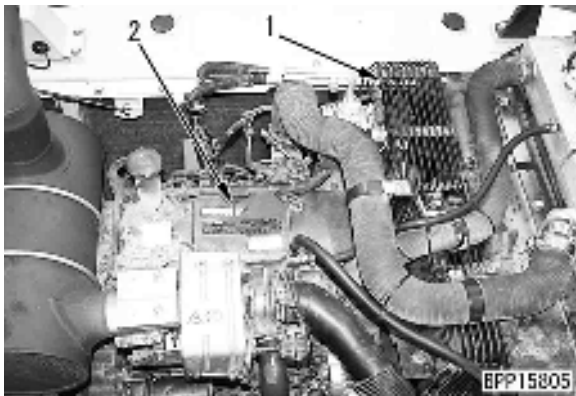
⚠ **Stop the machine on a level ground and lower the work equipment to the ground.**

- ★ Measure the valve clearance under the following condition.

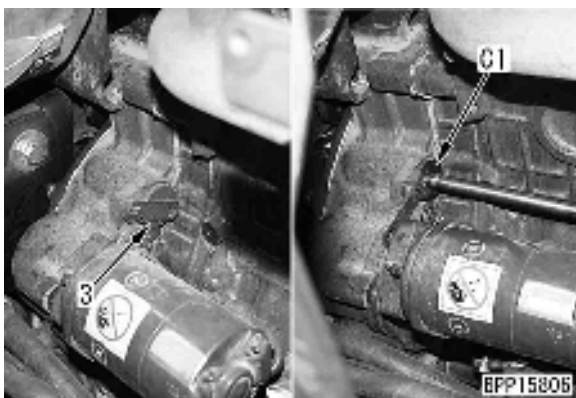
- Engine coolant temperature: Normal temperature

1. Open the engine hood and remove the belt guard (1) from the top of the air conditioner compressor.

2. Remove cylinder head cover (2).



3. Remove plug (3) from the top of the starting motor and insert gear C1.

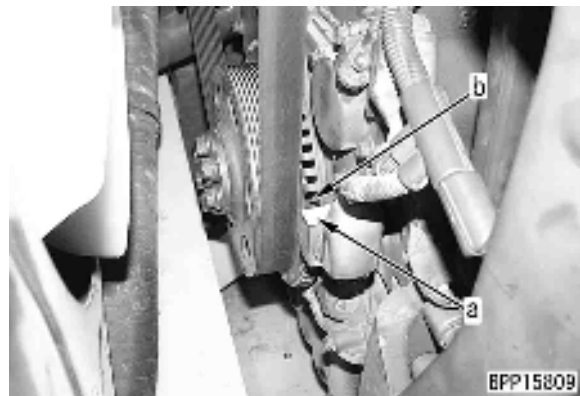


4. Rotate the crankshaft forward with gear C1 and set wide slit (b) of the rotation sensor ring to projection top (a) of front cover.

- ★ Projection top (a) must be within the range of wide slit (b) when it is seen from the air conditioner compressor side.

- ★ If you can see the yellow marks of projection top (a) and wide slit (b), you may set them to each other.

⚠ **When the crankshaft is set as above, the piston in the No. 1 or No. 4 cylinder is not set to the compression top dead centre (TDC). Take care.**



5. Check the movement of the rocker arm of the No. 1 cylinder to judge the valve to be adjusted.

- ★ If you can move the rocker arms of air exhaust valves (EX) with the hand by the valve clearance, adjust the valves marked with ● in the valve arrangement drawing.

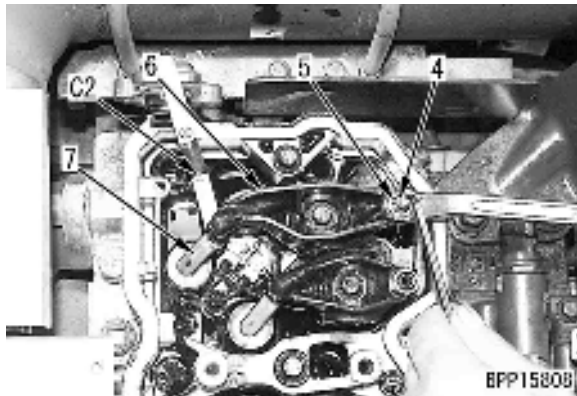
- ★ If you can not move the rocker arms of exhaust valves (EX) with the hand by the valve clearance, adjust the valves marked with ○ in the valve arrangement drawing.

- ★ Valve arrangement drawing

No.	1	2	3	4
EX	●	○	●	○
IN	○	●	○	●

BJP15807

6. Adjust the valve clearance according to the following procedure.
 - 1) While fixing adjustment screw (4), loosen locknut (5).
 - 2) Insert thickness gauge **C2** in the clearance between rocker arm (6) and crosshead (7) and adjust the valve clearance with adjustment screw (4).
 - ★ With the clearance gauge inserted, turn the adjustment screw to a degree that you can move the clearance gauge lightly.
 - 3) While fixing adjustment screw (4), tighten locknut (5).
 - 🔧 Locknut:
 $24 \pm 4 \text{ Nm } \{2.45 \pm 0.41 \text{ kgm}\}$
 - ★ After tightening the locknut, check the valve clearance again.



7. Rotate the crankshaft forward by 1 turn and set wide slit (b) to projection top (a) according to step (4).
8. Adjust the other valve clearances according to steps (5) and (6).
 - ★ If the valves marked with ● in the valve arrangement drawing were adjusted in steps (5) and (6), adjust the valves marked with ○.
 - ★ If the valves marked with ○ in the valve arrangement drawing were adjusted in steps (5) and (6), adjust the valves marked with ●.
9. After finishing adjustment, remove the adjusting tools and return the removed parts.
 - ⚠ **Remove gear C1 without fail.**
 - 🔧 Cylinder head cover mounting nut:
 $24 \pm 4 \text{ Nm } \{2.45 \pm 0.41 \text{ kgm}\}$

Measuring compression pressure

★ Measuring tools for compression pressure

Symbol		Part No.	Part name
D	1	795-502-1590	Compression gauge
	2	795-799-6700	Puller
	3	795-790-4410	Adapter
		6754-11-3130	Gasket

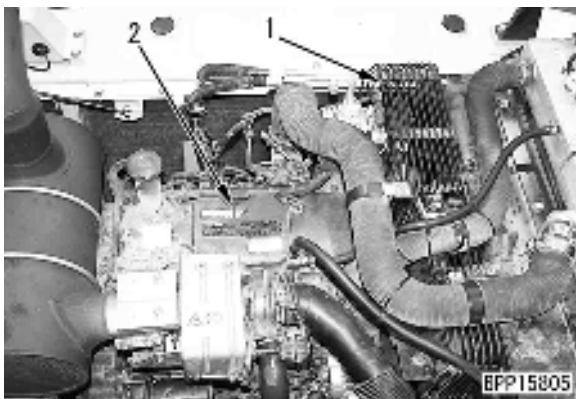
⚠ **Stop the machine on a level ground and lower the work equipment to the ground.**

★ Measure the compression pressure under the following condition.

- Engine oil temperature: 40 – 60°C

1. Open the engine hood and remove belt guard (1) from the top of the air conditioner compressor.

2. Remove cylinder head cover (2).



3. Remove the mounting bolts of rocker arm assembly (3) on the exhaust side, and then remove rocker arm assembly (3).

★ When removing the injector, you do not need to remove the rocker arm assembly on the intake side.

4. Remove fuel tube (4), and then remove inlet connector (7) in the cylinder head.

★ The inlet connector is connecting the fuel tube to the injector.



5. Disconnect injector wiring harness. Using tool **D2**, remove injector (5).



6. Install adapter **D3** to the injector mounting part with the injector holder and connect compression gauge **D1**.

★ Install the gasket to the adapter end without fail.

★ Tighten the holder mounting bolts alternately.

⌚ Injector holder mounting bolt:

$8 \pm 0.8 \text{ Nm}$ { $0.8 \pm 0.08 \text{ kgm}$ }

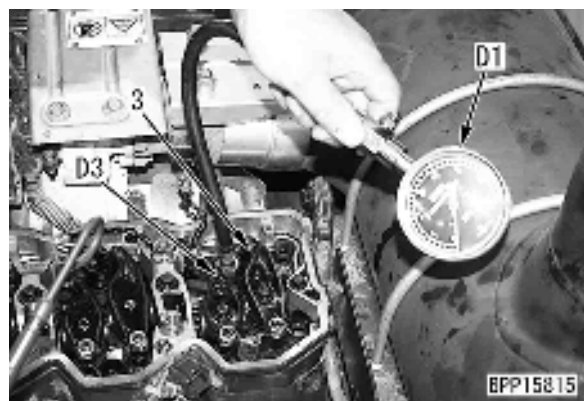
★ If a little quantity of engine oil is applied to the joint of the adapter and gauge, air does not leak easily.

7. Install rocker arm assembly (3) on the exhaust side and adjust the valve clearance.

⌚ Rocker arm assembly mounting bolt:

$36 \pm 5 \text{ Nm}$ { $3.67 \pm 0.5 \text{ kgm}$ }

★ See "Adjusting valve clearance".



8. Disconnect **CE03** connector (6) of the engine controller.

⚠ **If the connector is not disconnected, the engine will start during measurement and it will be dangerous.**

⚠ **Since the CE03 connector is a part of the power supply circuit of the engine controller, cover the connector on the machine side with a vinyl sheet, etc. to prevent electric leakage and ground fault.**



9. Rotate the engine with the starting motor and measure the compression pressure.

★ Read the gauge when the pointer is stabilized.

10. After finishing measurement, remove the measuring tools and return the removed parts.

★ Install the injector and inlet connector according to the following procedure.

- 1) Apply new engine oil (SAE15W-40) to the O-ring of injector (5) and cylinder head.
- 2) Install injector (5) with the fuel inlet hole directed to the air intake manifold.
- 3) Install injector holder (8) and tighten the mounting bolt by 3 – 4 threads.
- 4) Install inlet connector (7) and tighten inlet connector retainer (9) temporarily.
- 5) Tighten the mounting bolt of injector holder (8) securely.

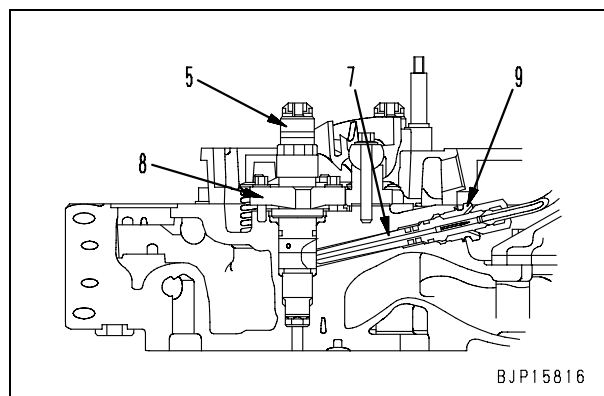
⌘ Injector holder mounting bolt:

$8 \pm 0.8 \text{ Nm}$ { $0.8 \pm 0.08 \text{ kgm}$ }

- 6) Tighten inlet connector retainer (9) securely.

⌘ Inlet connector retainer:

$50 \pm 5 \text{ Nm}$ { $5.1 \pm 0.5 \text{ kgm}$ }



★ Tighten the bolts and nuts other than the injector and inlet connector to the following torque.

⌘ Injector wiring harness nut:

$1.5 \pm 0.25 \text{ Nm}$ { $0.15 \pm 0.026 \text{ kgm}$ }

⌘ Fuel tube sleeve nut:

$35 \pm 3.5 \text{ Nm}$ { $3.6 \pm 0.4 \text{ kgm}$ }

⌘ Rocker arm assembly mounting bolt:

$36 \pm 6 \text{ Nm}$ { $3.7 \pm 0.6 \text{ kgm}$ }

★ Adjust the valve clearance. For details, see "Adjusting valve clearance".

⌘ Cylinder head cover mounting nut:

$24 \pm 4 \text{ Nm}$ { $2.45 \pm 0.41 \text{ kgm}$ }

Measurement of blow-by pressure

★ Measuring tools for blow-by pressure

Symbol		Part No.	Part name
E	1	799-201-1504	Blow-by checker
	2	795-790-3300	Blow-by tool

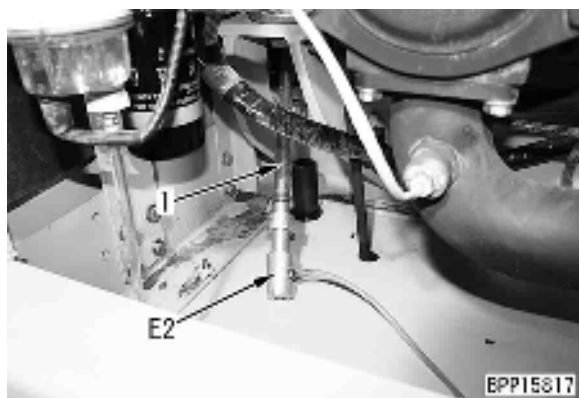
⚠ **Stop the machine on a level ground and lower the work equipment to the ground.**

★ Measure the blow-by pressure under the following condition.

- Engine coolant temperature: Within operating range
- Hydraulic oil temperature: Within operating range

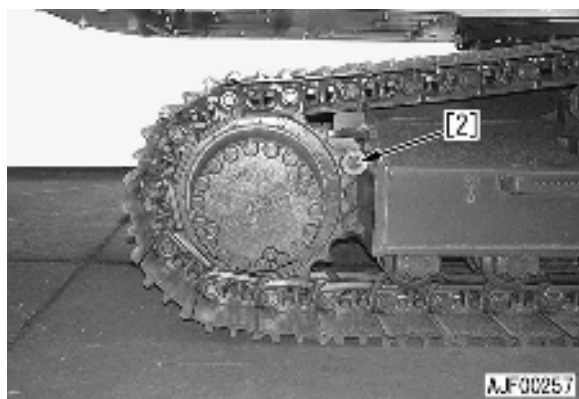
1. Open the side cover of the pump room.

2. Fit tool **E2** to blow-by hose (1) and connect it with gauge [1] of blow-by KIT **E1**.



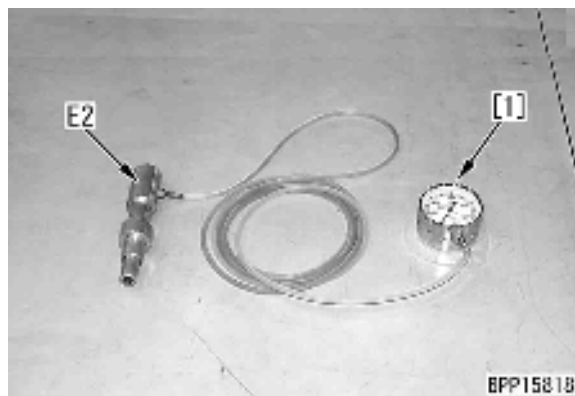
3. Start the engine, and lock (left and right) the travel.

⚠ **Insert pin [2] in between the sprocket and the track frame to make sure to block the travel.**



4. Measure the blow-by pressure at the engine high idle and under the following conditions.
- Working mode: P mode
 - Work equipment, swing and travel: Left and right travel relief

★ Read off the blow-by pressure value, when the needle of the gauge steadies itself.



5. Detach the measurement tools after the measurement, and make sure that the machine is back to normal condition.

Measuring engine oil pressure

★ Measuring tools for engine oil pressure

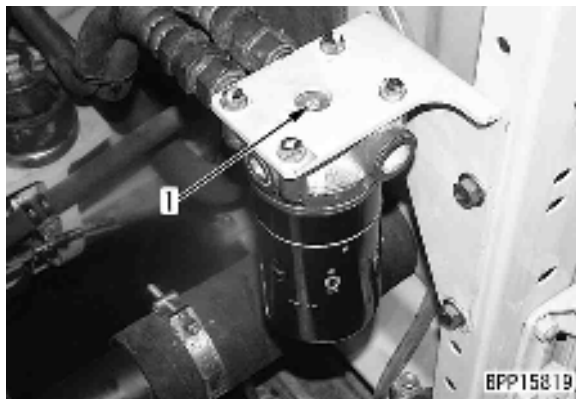
Symbol	Part No.	Part name
F	1	799-101-5002 Hydraulic tester
		790-261-1204 Digital hydraulic tester
	2	799-401-2320 Hydraulic tester

⚠ **Stop the machine on a level ground and lower the work equipment to the ground.**

★ Measure the engine oil pressure under the following condition.

- Engine coolant temperature: Within operating range

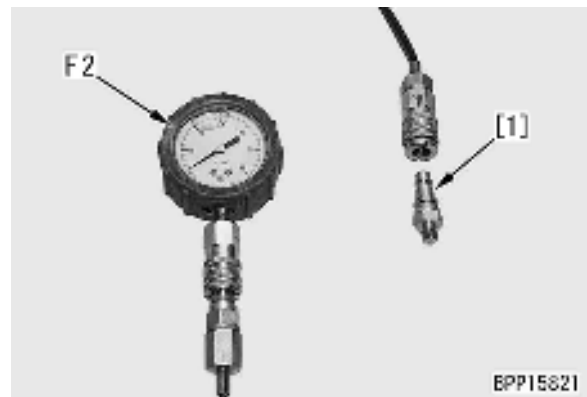
1. Open the side cover of the pump room and remove oil pressure pickup plug (1) (R1/8) from the engine oil filter.



2. Install nipple [1] of hydraulic tester F1 and connect hydraulic tester F2.



3. Start the engine and turn the auto-decelerator OFF.
4. Run the engine and measure the engine oil pressure at high idle and low idle.



5. After finishing measurement, remove the measuring tools and return the removed parts.

Handling fuel system parts

- ★ Precautions for checking and maintaining fuel system
The common rail fuel injection system (CRI) consists of more precise parts than the conventional fuel injection pump and nozzle. If foreign matter enters this system, it can cause a trouble.
When checking and maintaining the fuel system, take care more than the past. If dust, etc. sticks to any part, wash that part thoroughly with clean fuel.
- ★ Precautions for replacing fuel filter cartridge
Be sure to use the Komatsu genuine fuel filter cartridge.
Since the common rail fuel injection system (CRI) consists of more precise parts than the conventional fuel injection pump and nozzle, it employs a high-efficiency special filter to prevent foreign matter from entering it. If a filter other than the genuine one is used, the fuel system may have a trouble. Accordingly, never use such a filter.

Releasing residual pressure from fuel system

- ★ Pressure is generated in the low-pressure circuit and high-pressure circuit of the fuel system while the engine is running.
Low-pressure circuit:
Feed pump – Fuel main filter – Supply pump
High-pressure circuit:
Supply pump – Common rail – Injector
- ★ The pressure in both low-pressure circuit and high-pressure circuit lowers to a safety level automatically 30 seconds after the engine is stopped.
- ★ Before the fuel circuit is checked and its parts are removed, the residual pressure in the fuel circuit must be released completely. Accordingly, observe the following.
- ⚠ **Before checking the fuel system or removing its parts, wait at least 30 seconds after stopping the engine until the residual pressure in the fuel circuit is released. (Do not start the work just after stopping the engine since there is residual pressure.)**

Measuring fuel pressure

★ Measuring tools for fuel pressure

Symbol	Part No.	Part name
G	1	799-101-5002 Hydraulic tester
		790-261-1204 Digital hydraulic tester
	2	795-790-4430 Adapter (10 × 1.0 mm → R1/8)
		6215-81-9710 O-ring
	3	795-790-5200 Fuel pressure gauge adapter kit
	4	799-401-2320 Hydraulic tester

⚠ **Stop the machine on a level ground and lower the work equipment to the ground.**

★ Measure only the fuel pressure in the low-pressure circuit from the feed pump through the fuel main filter to the supply pump and the return circuit from the supply pump/common rail/injector to fuel tank.

⚠ **Since the pressure in the high-pressure circuit from the supply pump through the common rail to the injector is very high, it cannot be measured.**

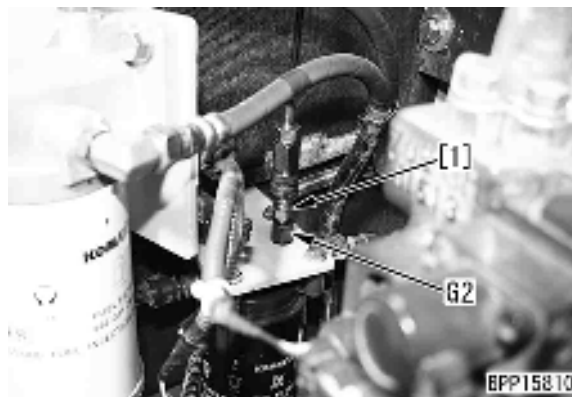
1. Measuring pressure in fuel low-pressure circuit

- 1) Open the side cover of the pump room and remove fuel pressure pickup plug (fuel inlet side) (1) from the fuel main filter.



- 2) Install adapter **G2** and nipple [1] of hydraulic tester **G1** and connect them to oil pressure gauge [2].

★ Use the oil pressure gauge of 2.5 MPa {25 kg/cm²}.

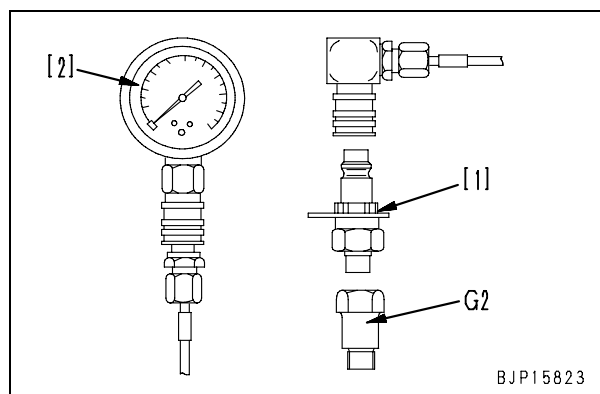


- 3) Run the engine at low idle and measure the pressure in the fuel low-pressure circuit.

★ If the pressure in the fuel low-pressure circuit is in the following range, it is normal.

At low idle	0.5 – 1.3 MPa {5.1 – 13.3 kg/cm ² }
During cranking	0.3 – 1.1 MPa {3.1 – 11.3 kg/cm ² }

⚠ **If the engine cannot be started, you may measure the fuel pressure while rotating the engine with the starting motor. Do not rotate for more than 20 seconds continuously, however, for protection of the starting motor.**

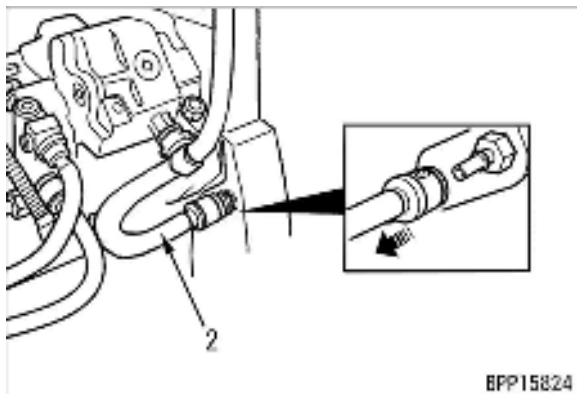


- 4) After finishing measurement, remove the measuring tools and return the removed parts.

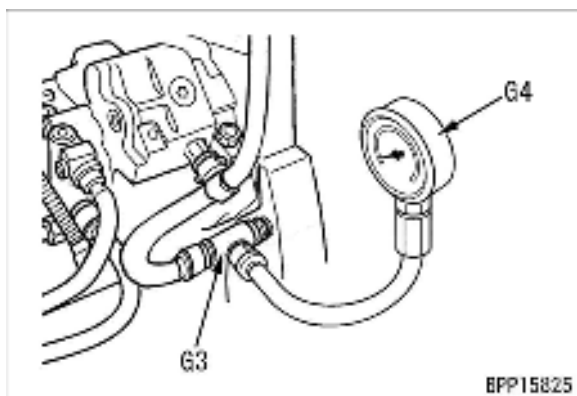
🔧 Fuel pressure pickup plug:
10 ± 2 Nm {1 ± 0.2 kgm}

2. Measuring pressure in fuel return circuit

- 1) Disconnect fuel return hose (2).



- 2) Install fuel pressure gauge adapter kit **G3** and connect it to hydraulic tester **G4**.



- 3) Run the engine at low idle and measure the pressure in the fuel return circuit.
 - ★ If the pressure in the fuel return circuit is in the following range, it is normal.

At low idle	Max. 0.02 MPa
During cranking	{Max. 0.19 kg/cm ² }

⚠ If the engine cannot be started, you may measure the fuel pressure while rotating the engine with the starting motor. Do not rotate for more than 20 seconds continuously, however, for protection of the starting motor.

- 4) After finishing measurement, remove the measuring tools and return the removed parts.

Measuring fuel discharge, return and leakage

- ★ Measuring tools for fuel discharge, return and leakage

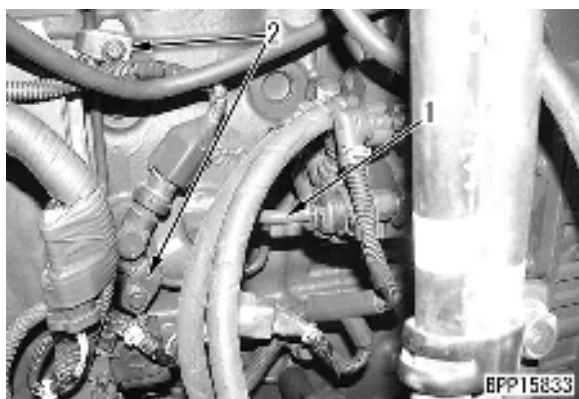
Symbol	Part No.	Part name
H	1	Commercially available Hose (Internal dimension: $\varnothing 14$ mm)
	2	795-790-4700 Tester kit
	3	795-790-6700 Adapter
	4	6754-71-5340 Connector
	5	6754-71-5350 Washer
	6	Commercially available Measuring cylinder
	7	Commercially available Stopwatch
	7	Commercially available Hose (Internal dimension: $\varnothing 12$ mm)

- ★ Since some fuel flows out during check, prepare an oil (receiving) pan of about 20 ℓ .

⚠ Stop the machine on a level ground and lower the work equipment to the ground.

1. Measuring discharge from supply pump

- Open the engine hood, loosen 2 clamps (2) from discharge side tube (1) of the supply pump, and disconnect tube (1).



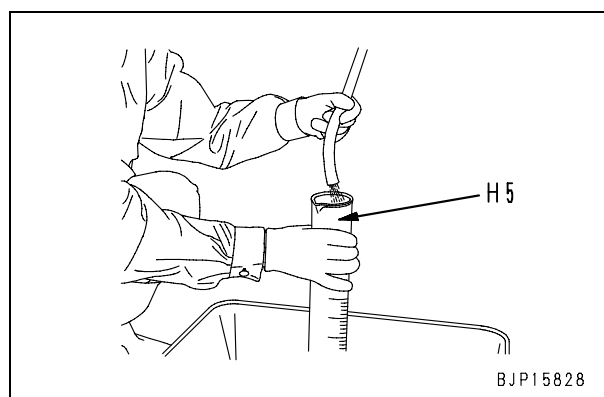
- Install measuring hose **H1** to the discharge side nipple of the supply pump.
 - ★ Fix the hose using a wire to prevent the hose from coming off.
 - ★ Adjust the route inspection hose so that there is no slack, and insert its end to the oil pan.



- Crank the engine for 30 seconds and measure the discharge with measuring cylinder **H5**.

- ★ In order to protect the starter motor, it is prohibited to continue cranking for more than 30 seconds for any other purpose than this measurement.
- ★ If the discharge from the supply pump is in the following range, it is normal.

Engine Speed	Discharge
125 rpm	Min. 75 cc
150 rpm	Min. 90 cc



- After finishing checking, remove the measuring tools and return the removed parts.

- Tube sleeve nut:
 35 ± 3.5 Nm $\{3.6 \pm 0.4$ kgm $\}$
- Clamp mounting bolt:
 24 ± 4 Nm $\{2.45 \pm 0.4$ kgm $\}$

2. Measuring return rate from supply pump

- 1) Open the engine hood and disconnect return hose (3) of the supply pump.
 - ★ The return hose is connected by a quick coupler.

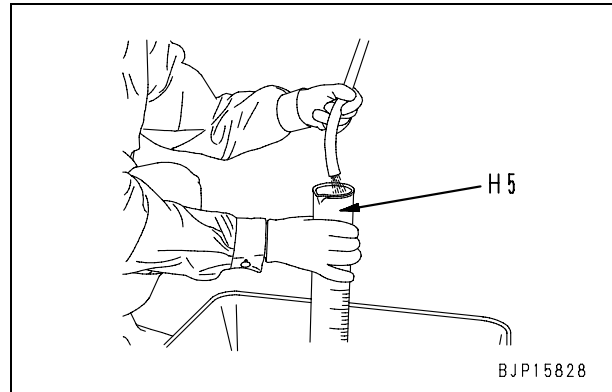


- 2) Install connector **H4** and the cap nut of tester kit **H2** to stop the fuel from flowing out.
- 3) Connect test hose [1] of tester kit **H2** to the supply pump.
 - ★ Lay the test hose so that it will not slacken and put its end in the oil (receiving) pan.



- 4) Run the engine at low idle and measure the return rate for 25 seconds with measuring cylinder **H5**.
 - ★ If the return rate from the supply pump is in the following range, it is normal.

At low idle (750 rpm)	Max. 400 cc
-----------------------	-------------



- 5) After finishing measurement, remove the measuring tools and return the removed parts.
 - ★ When measuring the leakage from the pressure limiter or finishing the measurement: Return the removed parts to their original positions.
 - ★ When measuring the leakage from the injector: Leave the removed parts as they are and keep the hose end in the oil pan.

3. Measuring leakage from pressure limiter

- 1) Open the engine hood and disconnect return hose (4) of the pressure limiter.

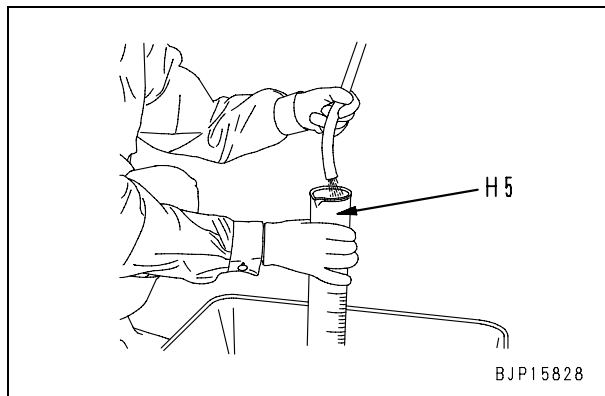


- 2) Install connector **H4** and the cap nut of tester kit **H2** to the return hose side, to stop the fuel from flowing out.
- 3) Connect the measuring hose [1] of tester kit **H2** to the common rail side.
 - ★ Lay the test hose so that it will not slacken and put its end in the oil (receiving) pan.



- 4) Run the engine at low idle and measure the return rate in 1 minute with measuring cylinder **H5**.
 - ★ If the leakage from the pressure limiter is in the following range, it is normal.

At low idle	0 cc (No leakage)
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- 5) After finishing measurement, remove the measuring tools and return the removed parts.

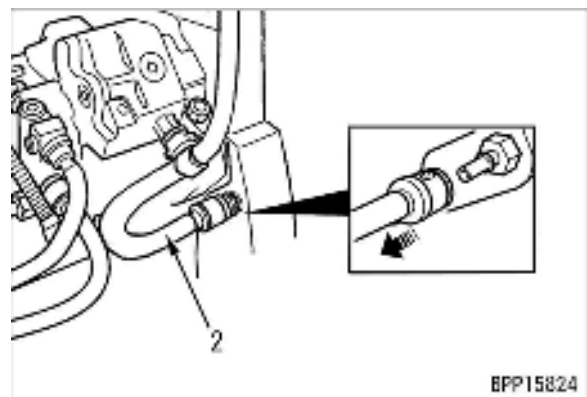
4. Measuring return rate from injector

- ★ The leakage from the injector is measured while the return hose of the pressure limiter is connected. Accordingly, before measuring the leakage from the injector, check that the leakage from the pressure limiter is normal.

- 1) Referring to "Measuring return rate from supply pump", set the supply pump for testing.

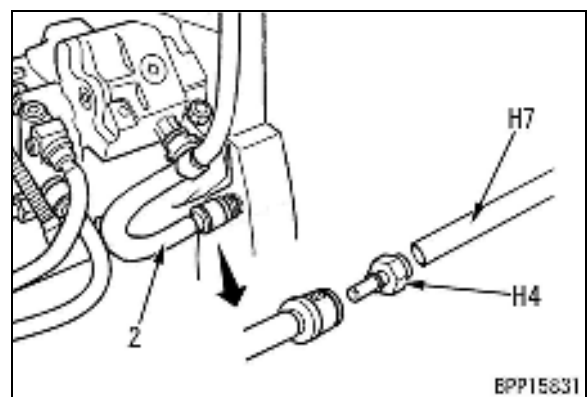
⚠ The fuel returning from the supply pump flows out during measurement of the return rate from the injector. Accordingly, keep the test hose end in the oil pan.

- 2) Disconnect return hose (2) of the manifold part.



- 3) Install connector **H4** to hose (2), and connect it to hose **H7**.

- ★ Fix the hose using a wire to prevent the hose from coming off.
- ★ Lay the test hose so that it will not slacken and put its end in the oil (receiving) pan.

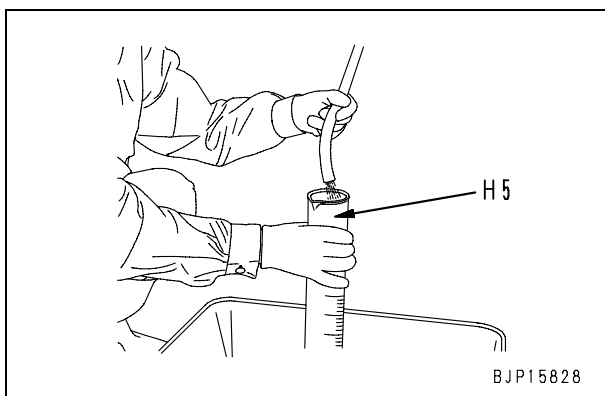


- 4) Run the engine at low idle and measure the return rate in 1 minute with measuring cylinder **H5**.

★ If the return rate from the injector is in the following range, it is normal.

At low idle	Max. 120 cc/min
During cranking	Max. 90 cc/min

⚠ If the engine cannot be started, you may measure the fuel return rate while rotating the engine with the starting motor. Do not rotate for more than 20 seconds continuously, however, for protection of the starting motor.



- 5) After finishing measurement, remove the measuring tools and return the removed parts.

🔧 Joint bolt:

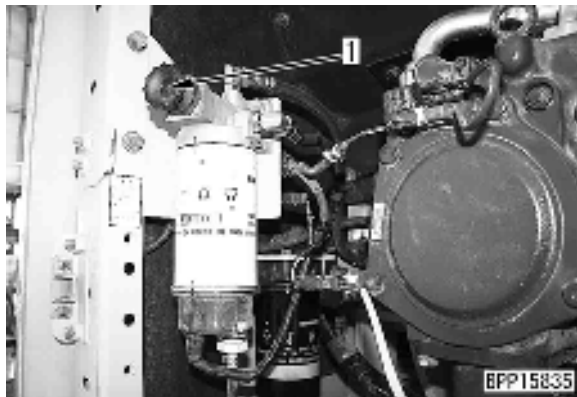
19.6 – 29.4 Nm {2.0 – 3.0 kgm}

Bleeding air from fuel circuit

- ★ If fuel is used up or if a fuel circuit part is removed and installed, bleed air from the fuel circuit according to the following procedure.

⚠ Stop the machine on a level ground and lower the work equipment to the ground.

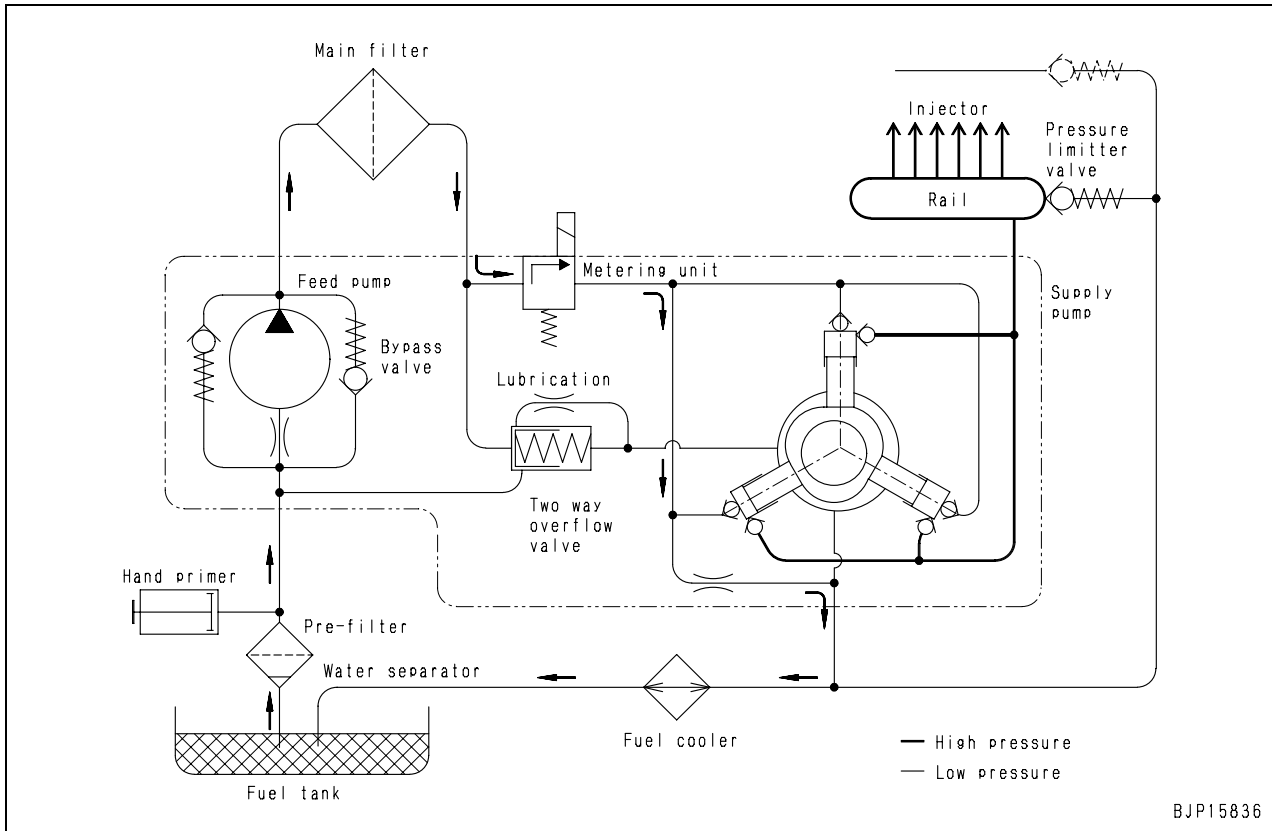
1. Fill the fuel tank with fuel.
 - ★ Add fuel until the float of the sight gauge reaches the maximum position.
2. Open the side cover of the pump room.
3. Loosen knob (1) of the feed pump and pull it out, and then operate it forward and backward.
 - ★ Move the knob until it becomes heavy.
 - ★ The plug at the top of the fuel main filter does not need to be removed.



4. After bleeding air, push in and tighten knob (1).

★ Air bleeding route of fuel circuit

Fuel tank → Pre-filter → Feed pump → Main filter → Metering unit → Fuel tank



Checking fuel circuit for leakage

⚠ Very high pressure is generated in the high-pressure circuit of the fuel system. If fuel leaks while the engine is running, it is dangerous since it can catch fire.

After checking the fuel system or removing its parts, check it for fuel leakage according to the following procedure.

⚠ Stop the machine on a level ground and lower the work equipment to the ground.

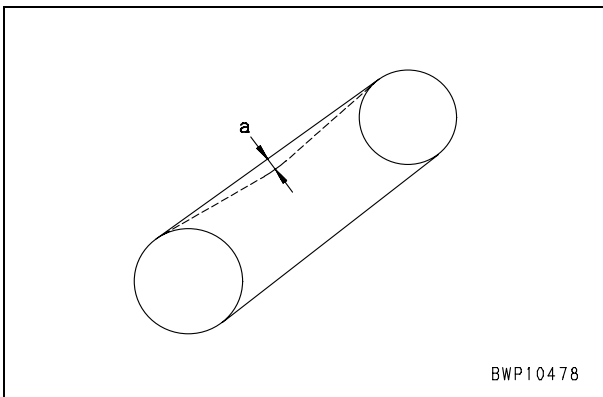
- ★ Clean and degrease the engine and the parts around it in advance so that you can check it easily for fuel leakage.
1. Spray colour checker (developer) over the fuel supply pump, common rail, fuel injector, and joints of the high-pressure piping.
 2. Run the engine at speed below 1,000 rpm and stop it after its speed is stabilized.
 3. Check the fuel piping and devices for fuel leakage.
 - ★ Check mainly around the high-pressure circuit parts coated with the colour checker for fuel leakage.
 - ★ If any fuel leakage is detected, repair it and check again from step 2.
 4. Run the engine at low idle.
 5. Check the fuel piping and devices for fuel leakage.
 - ★ Check mainly around the high-pressure circuit parts coated with the colour checker for fuel leakage.
 - ★ If any fuel leakage is detected, repair it and check again from step 2.
 6. Run the engine at high idle.
 7. Check the fuel piping and devices for fuel leakage.
 - ★ Check around the high-pressure circuit parts coated with the colour checker for fuel leakage.
 - ★ If any fuel leakage is detected, repair it and check again from step 2.
 8. Run the engine at high idle and load it.
 - ★ Relieve the arm circuit at the IN stroke end.
 9. Check the fuel piping and devices for fuel leakage.
 - ★ Check mainly around the high-pressure circuit parts coated with the colour checker for fuel leakage.
 - ★ If any fuel leakage is detected, repair it and check again from step 2.
 - ★ If no fuel leakage is detected, check is completed.

Checking and adjusting air conditioner compressor belt tension

⚠ **Stop the machine on a level ground and lower the work equipment to the ground.**

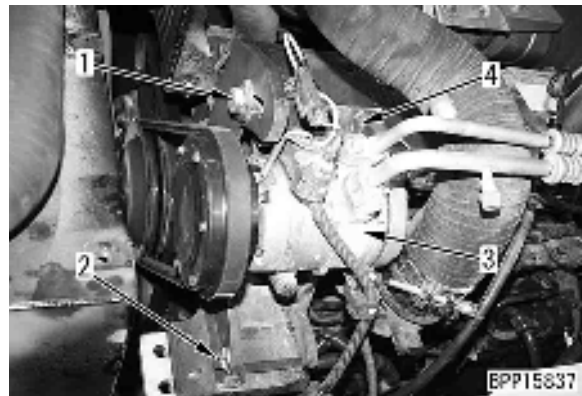
Checking

1. Open the engine hood and remove the belt guard from the top of the air conditioner compressor.
2. Press the intermediate point of the belt between fan pulley and compressor pulley with a finger and measure deflection (a) of the belt.
 - Belt pressing force: 58.8 N {6 kg}



Adjusting

- ★ If the belt deflection is abnormal, adjust it according to the following procedure.
1. Loosen bolts (1) and (2).
 2. Move compressor (3) and bracket (4) together to adjust the belt tension.
 3. After positioning compressor (3), tighten bolts (1) and (2).
 - ★ Check each pulley for breakage, wear of the V-groove, and contact of the V-belt and V-groove.
 - ★ If the V-belt is so lengthened that the adjustment allowance is eliminated or it has a cut or a crack, replace it.
 - ★ If the belt is replaced, adjust their tension again after operating the machine for 1 hour.
 - ★ After tightening the bolts, check the belt tension again according the above checking procedure.



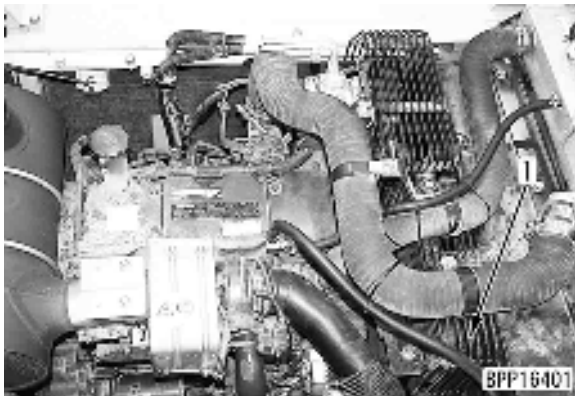
4. After finishing measurement, return the removed parts.

Replacing the fan belt

- ★ The auto-tensioner is provided for the fan belt. Thus, testing and adjustment of the belt is usually not necessary.
- ★ Disconnect air conditioner compressor belt before replacing the fan belt.

⚠ Parking the machine in a level ground and lower the work equipment to the ground.

1. Open engine hood and remove fan belt cover (1).

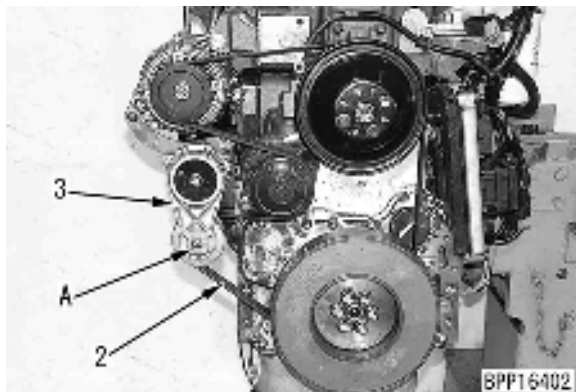


2. Insert a wrench to the portion (A) (width across flats \square 12.7 mm) of the tensioner assembly (3), and rotate it to the opposite to the winding-up direction to decrease the fan belt (2) tension.

⚠ Make sure that the wrench is secured at the portion (A) of the tensioner assembly (3) before rotating it. (The spring of the tensioner assembly (3) is strong. If the wrench is loosely inserted, the wrench may accidentally come off while being rotated and it is extremely dangerous.)

⚠ After removing the fan belt (2), return the tensioner assembly (3) slowly with care.

⚠ Be careful not to get your fingers caught between the pulley and fan belt (2) during work.



3. Replace the fan belt (2).
 - Check each pulley for breakage and crack.

PC160LC-7E0, PC180LC/NLC-7E0 Hydraulic excavator

Form No. UEN02108-00

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Printed in Belgium 09-07 (02)

HYDRAULIC EXCAVATOR

PC160LC-7E0

PC180LC-7E0

PC180NLC-7E0

Machine model Serial number

PC160LC-7E0	K45001 and up
PC180LC-7E0	K45001 and up
PC180NLC-7E0	K45001 and up

30 Testing and adjusting

Testing and adjusting, Part 2

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Measurement of clearance in swing circle bearings

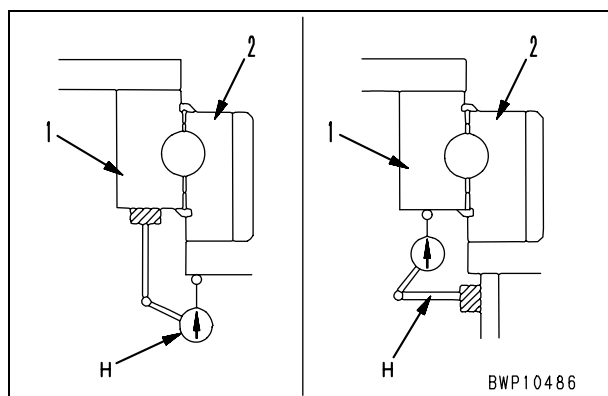
- ★ Swing circle bearing clearance measurement tools

Symbol	Part No.	Part name
J	Commercially available	Dial gauge

- ★ Follow the steps explained below, when measuring clearance in the swing circle bearing in the actual machine.

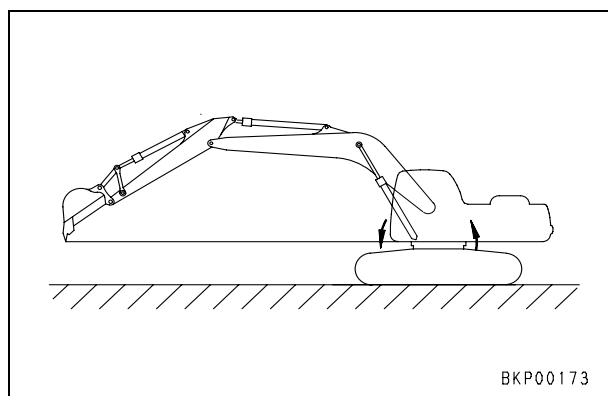
⚠ Be careful not to put a hand or foot under the undercarriage, while taking measurement.

1. Fasten dial gauge **J** to swing circle outer race (1) or inner race (2), and contact the probe with the end surface of inner race (2) or outer race (1) on the opposite side.
 - ★ Set dial gauge **J** at the machine front or rear.



2. Keep the work equipment in the max. reach posture and keep the height of the bucket teeth tip level with the lower height of the revolving frame.
 - ★ The upper structure is lowered at the front and raised at the rear at that time.

3. Set dial gauge **J** at zero point.

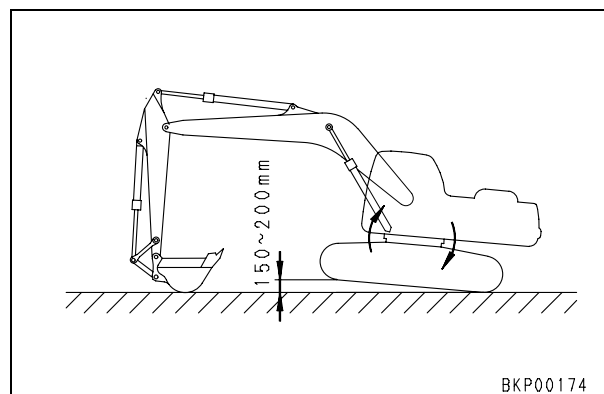


4. Hold the arm nearly perpendicular to the ground, and lower the boom until the track shoes will be lifted at the machine front.

- ★ The upper structure is raised at the front and lowered at the rear at that time.

5. Read off the value in dial gauge **J** in this condition.

- ★ The value indicated in dial gauge **J** expresses clearance in the bearings.



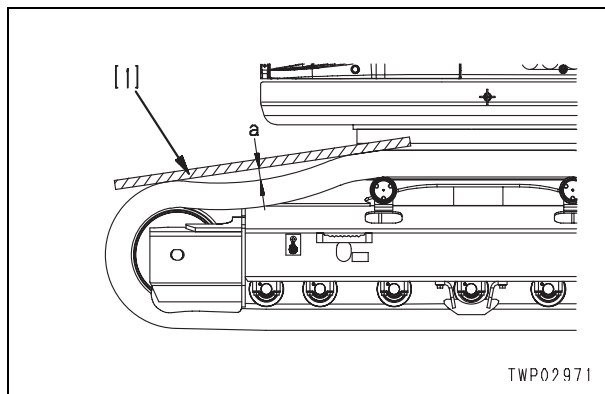
6. Return the machine to the posture in Item 2 above, and confirm reading of dial gauge **J** is zero.

- ★ If zero value is not indicated, repeat the steps in Items 3 through 5.

Checking and adjusting track shoe tension

Checking

1. Travel the machine forward by the length of track on ground with the engine at low idle and then stop the machine slowly.
2. Place straight bar [1] on the track shoe between the idler and the 1st carrier roller.
 - ★ L beam is recommended for bar [1] because of its deflection-free nature.
3. Measure maximum clearance (a) between bar [1] and the track shoe.
 - Standard clearance (a): 10 – 30 mm

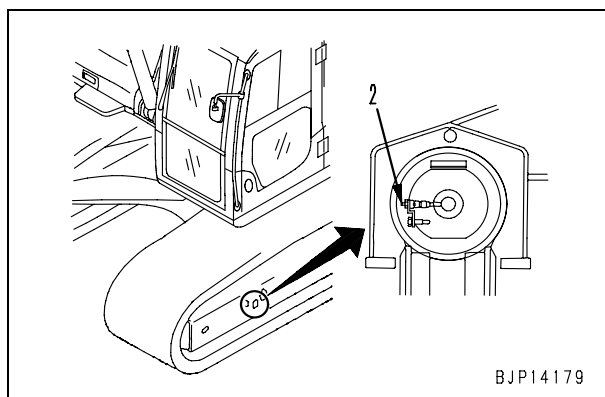


Adjusting

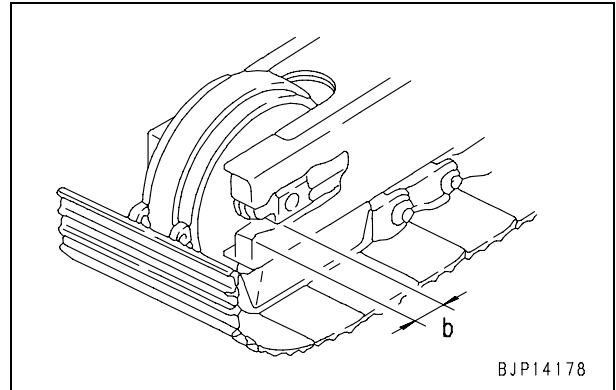
- ★ If the track shoe tension is abnormal, adjust it according to the following procedure.

1. Increasing tension

- 1) Add grease through grease fitting (2) with a grease gun.
- 2) To check that the tension is normal, run the engine at low idle and move the machine forward slowly by the length of track on ground, then stop.
- 3) After adjusting, check the track shoe tension according to the above procedure.

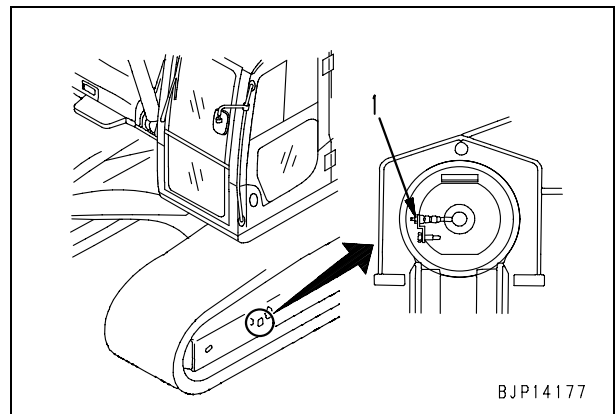


- ★ You may add grease until dimension (b) between the idler guide and track frame end becomes 0 mm. If the tension is still low, the pins and bushings are worn much. In this case, reverse or replace the pins and bushings.



2. Decreasing tension

- 1) Loosen valve (1) to discharge grease, and then tighten it.
 - ⚠ **Do not loosen the valve more than 1 turn. If it is loosened more, it may jump out because of the high-pressure grease in it.**
- 2) To check that the tension is normal, run the engine at low idle and move the machine forward slowly by the length of track on ground, then stop.
- 3) After adjusting, check the track shoe tension according to the above procedure.

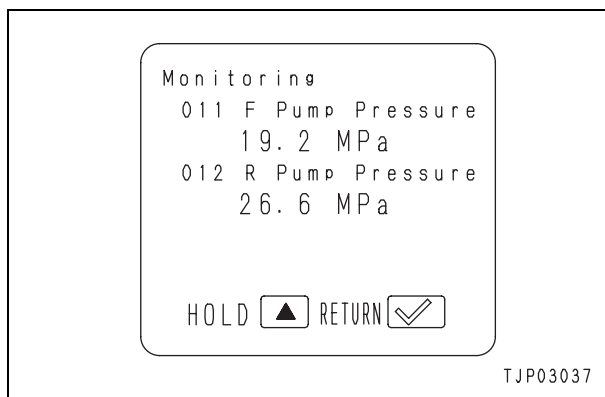


Inspection and adjustment oil pressure in work equipment, swing, and travel circuits

- ★ Instruments for inspecting and adjusting oil pressure in work equipment, swing, and travel circuits

Symbol	Part No.	Part name
K	1	799-101-5002 Hydraulic tester
		790-261-1204 Digital hydraulic tester
	2	799-101-5220 Nipple (10 x 1.25 mm)
		07002-11023 O-ring

- ★ Measurement of the oil pressure in the work equipment, swing, and travel circuits (pump discharge pressure) is also available from the monitoring function of the machine monitor (Special functions of machine monitor).

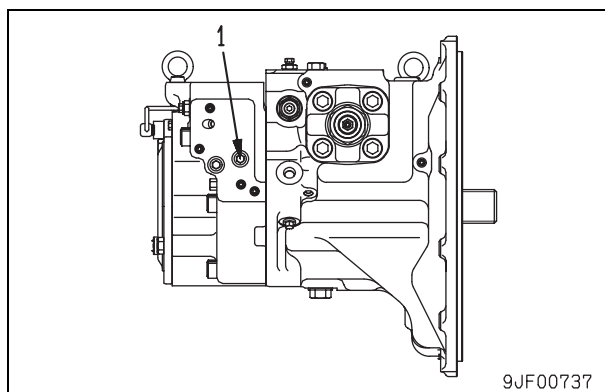


Measurement

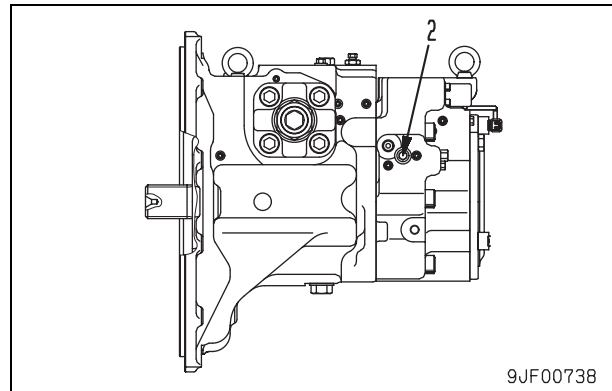
1. Preparation work

- ⚠ Lower the work equipment to the ground and stop the engine. Operate the control lever several times to release the residual pressure from the piping, and then loosen the oil filler cap of the hydraulic tank slowly to release the residual pressure from the tank.

- 1) Remove oil pressure pickup plugs (1) and (2).
- (1): Front pump discharge pressure pickup plug (PA1)



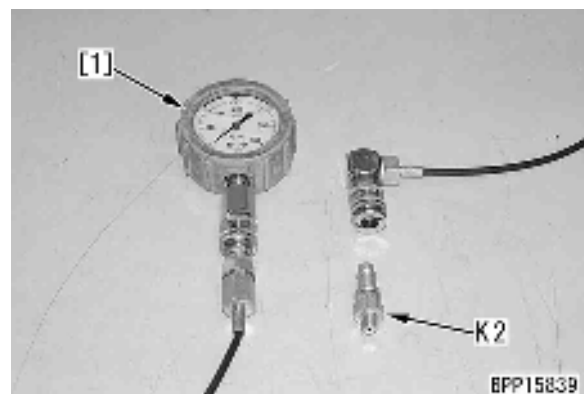
- (2): Rear pump discharge pressure pickup plug (PA2)



- 2) Install nipple **K2** and connect it to oil pressure gauge [1] of hydraulic tester **K1**.
- ★ Use the oil pressure gauge of 58.8 MPa {600 kg/cm²}.
 - ★ The measuring instruments installed to the front pump discharge pressure pickup port are shown in the figure.



- 3) Run the engine and heighten the hydraulic oil temperature to the operating range.



2. Combination of pump, actuator, and valve

- ★ When the pump is separated, the front pump and rear pump act independently on each actuator as shown in the table. Note that different actuators relieve different valves.
- ★ When the work equipment circuit or swing circuit are relieved singly, the oils of the pumps are merged. When the travel circuit is relieved singly, the oils of the pump are divided.
- ★ The actuators in the table are arranged in the order when the control valve is seen from the front of the machine (and 1 attachment is installed to the service valve).

Pump	Actuator	Valve relieved
(Centralized safety valve)		
Rear (PA2)	Service	Safety-suction valve
	Bucket	Main relief valve
	Arm	Main relief valve
	Boom	RAISE: Main relief valve LOWER: Safety-suction valve
(Front unload valve) (Rear unload valve) (Main relief valve) (Pump merge-divider valve) (Self-pressure reducing valve)		
Front (PA1)	Left travel	Main relief valve
Rear (PA2)	Right travel	Main relief valve
	Swing	Swing motor safety valve
(LS separate valve)		

3. Measurement of unload pressure

- 1) Start the engine.
- 2) Run the engine at high idle and set the all control levers in neutral and measure the oil pressure at this time.
 - ★ The pressure measured when the front and rear unload valves are unloaded is indicated.

4. Measurement of work equipment circuit relief pressure

- 1) Start the engine and move the cylinder to be measured to the stroke end.
- 2) Run the engine at high idle and relieve the cylinder and measure the oil pressure at this time.
 - ★ The pressure measured when the main relief valve is relieved is indicated.
 - ★ If the one-touch power maximizing switch is released, the valve is relieved at low pressure. If the former is pressed, the lower is relieved at high pressure.

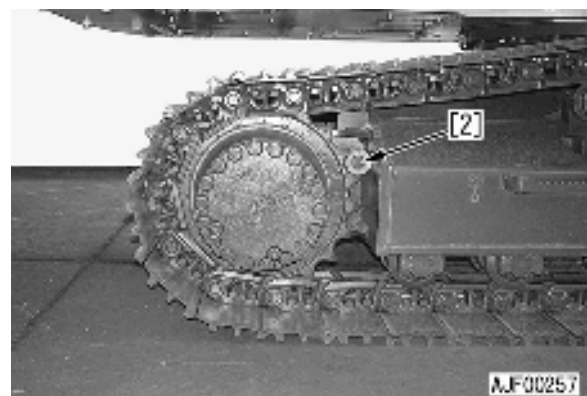
- ★ If the swing lock switch is turned ON, the constant 2-stage relief valve is turned ON and the valve is relieved at high pressure. Accordingly, keep the swing lock switch turned OFF.

5. Measurement of swing circuit relief pressure

- 1) Start the engine and turn the swing lock switch ON.
- 2) Run the engine at high idle and swing to the right and left to relieve the swing circuit and measure the oil pressure at this time.
 - ★ The pressure measured when the swing motor safety valve is relieved is indicated.
 - ★ The swing motor relief pressure is lower than the main relief valve.

6. Measurement of travel circuit relief pressure

- 1) Start the engine and lock the travel mechanism.
 - ⚠ **Set pin [2] between the sprocket and track frame to lock the travel mechanism securely.**



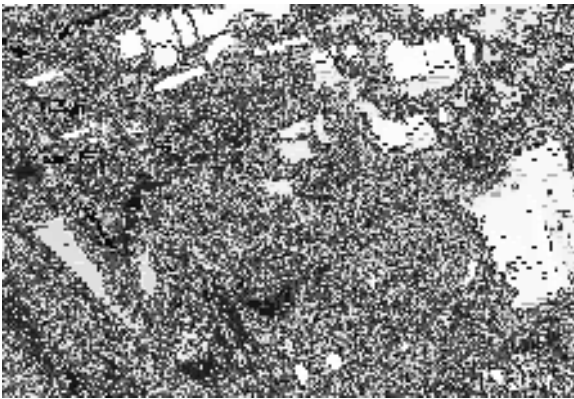
- 2) Run the engine at high idle and relieve the travel circuit and measure the oil pressure at this time.
 - ★ The pressure measured when the main relief valve is relieved is indicated. The travel circuit is always relieved at high pressure.

Adjusting

- ★ The unload valve and the boom lowering safety-suction valve cannot be adjusted.

1. Adjusting main relief pressure

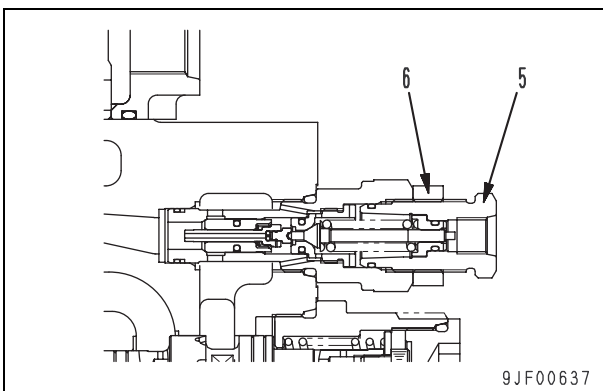
- ★ If the relief pressure of the work equipment circuit and/or travel circuit is abnormal, adjust main relief valve (3) according to the following procedure.
- ★ Adjust only the low relief pressure of the main relief valve. (If the low relief pressure is adjusted, the high relief pressure is adjusted automatically.)
- ★ The low relief pressure is the pressure applied when the 2-stage relief solenoid valve is turned OFF and the pilot pressure is not applied to the selector port.



- 1) Disconnect pilot hose (4).
- 2) Fixing holder (5), loosen locknut (6).
- 3) Turn holder (5) to adjust the pressure.
 - ★ If the holder is
 - Turned to the right, the pressure rises.
 - Turned to the left, the pressure lowers.
 - ★ Quantity of adjustment per turn of holder: Approx. 20.5 MPa {Approx. 209 kg/cm²}
- 4) Fixing holder (5), tighten locknut (6).

☞ Lock nut:

49.0 – 58.8 Nm {5 – 6 kgm}



- 5) Connect pilot hose (4).
- 6) After finishing adjustment, check again that the pressure is normal according to the procedure for measurement described above.

2. Adjusting swing relief pressure

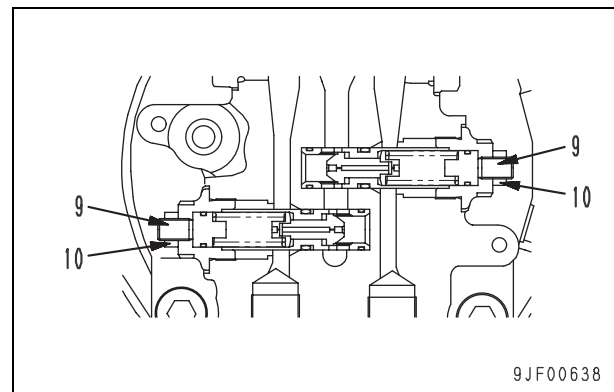
- ★ If the relief pressure of the swing circuit is abnormal, adjust swing motor safety valves (7) and (8) according to the following procedure.
 - (7): Right swing relief safety valve
 - (8): Left swing relief safety valve



- 1) Fixing screw (9), loosen locknut (10).
 - ★ Fix the screw with a hexagonal wrench.
- 2) Turn screw (9) to adjust the pressure.
 - ★ If the screw is
 - Turned to the right, the pressure rises.
 - Turned to the left, the pressure lowers.
 - ★ Quantity of adjustment per turn of screw: Approx. 9.8 MPa {Approx. 100 kg/cm²}
- 3) Fixing screw (9), tighten locknut (10).

☞ Lock nut:

39.2 ± 4.9 Nm {4.0 ± 0.5 kgm}



- 4) After finishing adjustment, check again that the pressure is normal according to the procedure for measurement described above.

Inspection and adjustment of control circuit oil pressure

★ Control circuit oil pressure inspection tools

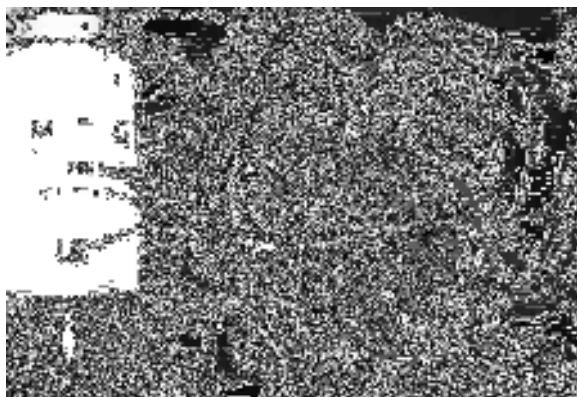
Symbol	Part No.	Part name
L	1	799-101-5002 Hydraulic tester
		790-261-1204 Digital hydraulic tester
	2	799-101-5220 Nipple (10 x 1.25 mm)
		07002-11023 O-ring

⚠ Lower the work equipment to the ground and stop the engine. After the engine stops, operate the control lever several times to release the remaining pressure in the piping. Then loosen the oil filler cap to release the pressure inside the hydraulic tank.

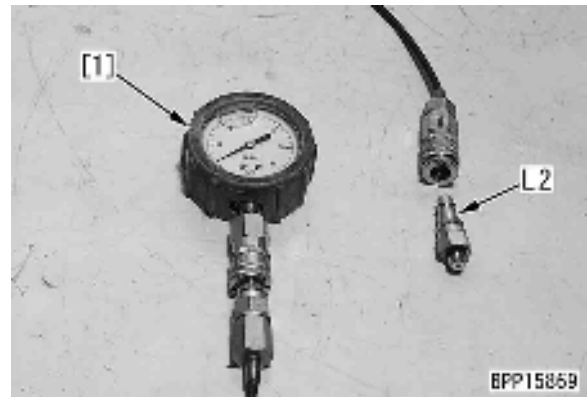
- Remove oil pressure pickup plug (1) of the pump.
 - (1): Control circuit basic pressure pickup plug



- Fit nipple **L2** and connect it to oil pressure gauge [1] of hydraulic tester **L1**.
 - ★ Use an oil pressure gauge with the capacity of 5.9 MPa {60 kg/cm²}.



- Start the engine and keep it running until the hydraulic oil temperature rises to the operating range.
- Measure oil pressure with the engine running at high idle and all the control levers in the NEUTRAL position.



- Detach all the measuring tools after the measurement, and make sure that the machine is back to normal condition.
 - ★ The relief valve for the control circuit basic pressure cannot be adjusted.

Inspection and adjustment of pump PC control circuit oil pressure

- ★ Pump PC control circuit oil pressure inspection and adjustment tools

Symbol	Part No.	Part name
M	1	799-101-5002 Hydraulic tester
		790-261-1204 Digital hydraulic tester
	2	799-101-5220 Nipple (10 x 1.25 mm)
		07002-11023 O-ring

Inspection

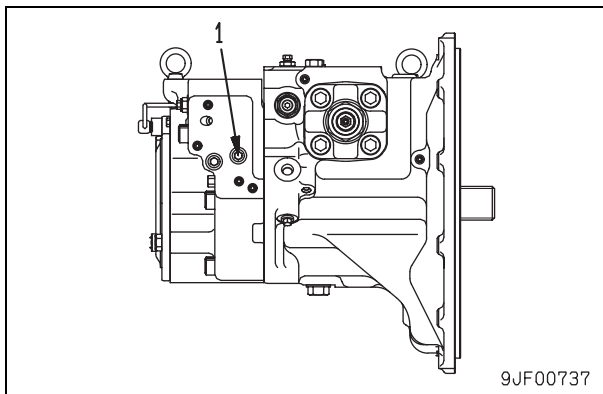
- ★ Implement measuring the pump PC control circuit oil pressure after confirming that the work equipment, swing and travel circuit oil pressure as well as the control circuit original oil pressure are normal.

⚠ Lower the work equipment to the ground and stop the engine. After the engine stops, operate the control lever several times to release the remaining pressure in the piping. Then loosen the oil filler cap to release the pressure inside the hydraulic tank.

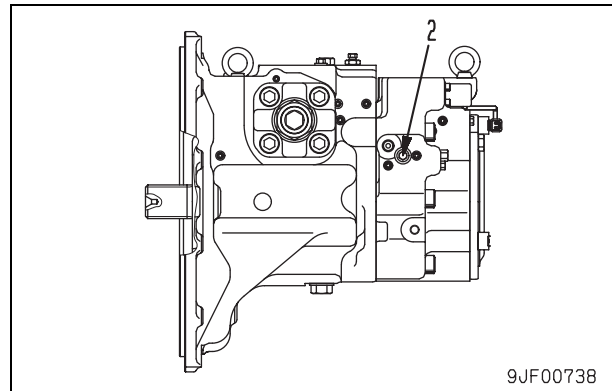
1. Inspection of PC valve output pressure (servo piston inlet pressure)

- ★ Measure the PC valve output pressure (servo piston inlet pressure) and pump discharge pressure (both F and R) simultaneously and compare them with each other.

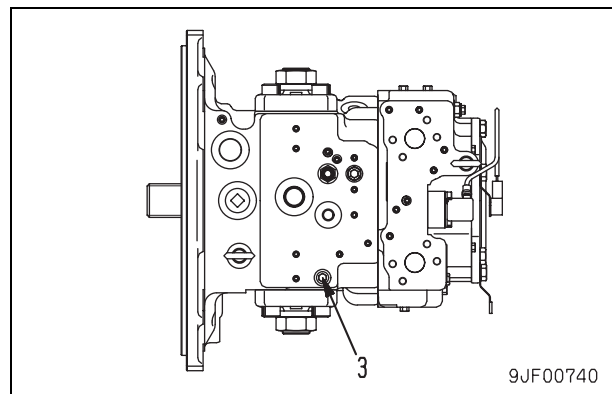
- 1) Remove oil pressure pickup plugs (1), (2), and (3).
 - (1): Front pump discharge pressure pickup plug (PA1)



- (2): Rear pump discharge pressure pickup plug (PA2)



- (3): PC valve output pressure pickup plug

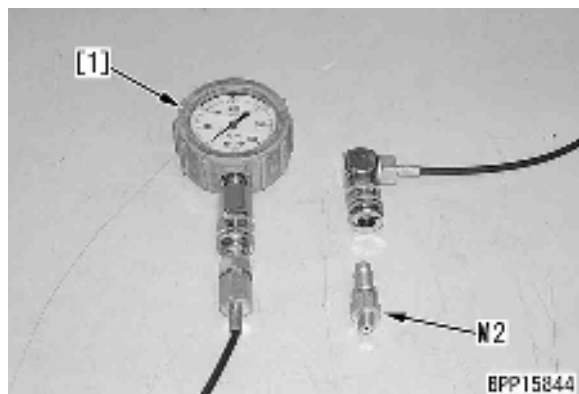


- 2) Fit nipple **M2** and connect to oil pressure gauge [1] of hydraulic tester **M1**.

- ★ Use an oil pressure gauge with the capacity of 58.8 MPa {600 kg/cm²}.
- ★ The measuring instruments installed to the PC valve output pressure pickup port are shown in the figure.



- 3) Start the engine and keep it running until the hydraulic oil temperature rises to the operating range.



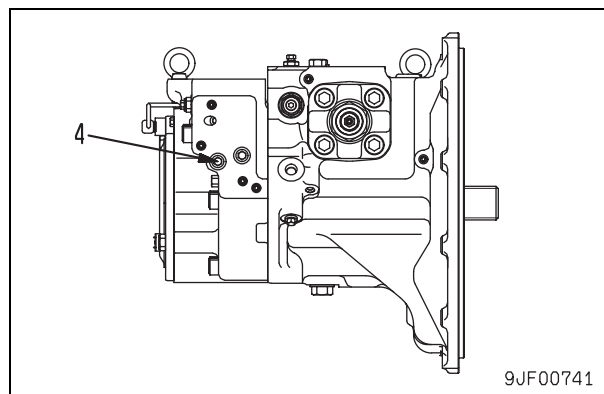
- 4) Measure the pump delivery pressure and PC valve output pressure (servo piston inlet pressure) together with the engine running at high idle, after setting the machine at the following conditions.
- Working mode: P mode
 - Swing lock switch: ON (switched to high pressure relief with 2-stage relief turned ON)
 - Work equipment, swing and travel circuit: Arm digging relief
 - ★ Judgement method:
When the ratio between the pump delivery pressure (Higher one of F and R) and PC valve output pressure (servo piston inlet pressure) reaches the following values, both pressures are judged normal.

Pressure to be measured	Pressure ratio
Pump delivery pressure	1
PC valve outlet pressure	Approx: 0.6 (Approx. 3/5)

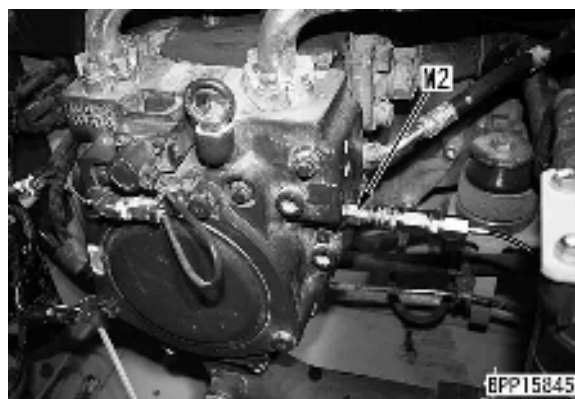
- ★ If there is any abnormality with PC valve or servo piston, the PC valve output pressure (servo piston inlet pressure) equals to the pump delivery pressure, or approximates to 0 pressure.
- 5) After finishing measurement, remove the measuring instruments and return the removed parts.

2. Measurement of PC-EPC valve output pressure

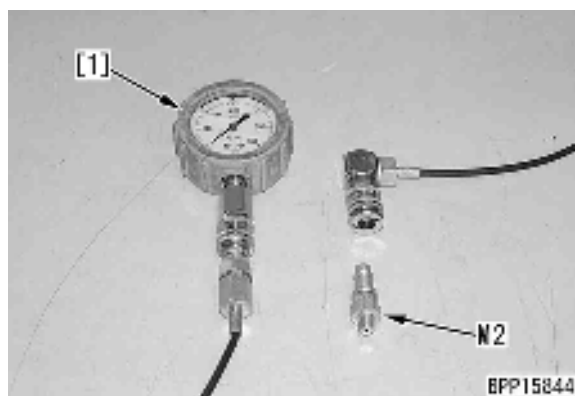
- 1) Remove oil pressure pickup plug (4).
- (4): PC-EPC valve output pressure pickup plug



- 2) Fit nipple **M2** and connect it to oil pressure gauge [1] of hydraulic tester **M1**.
- ★ Use an oil pressure gauge with the capacity of 5.9 MPa {60 kg/cm²}.



- 3) Start the engine and keep it running until the hydraulic oil pressure rises to the operating range.



- 4) Measure the hydraulic oil pressure with all the control levers kept in the NEUTRAL position and the engine running at high idle and at low idle.

★ If the PC-EPC valve output pressure changes as shown below, it is normal.

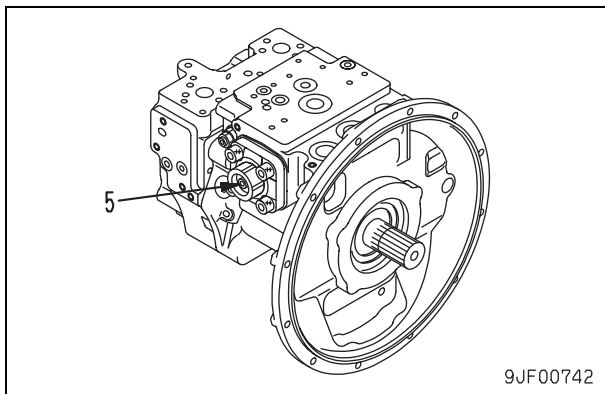
Engine	Control lever	Oil pressure
Low idle	Neutral	2.9 MPa {30 kg/cm ² }
High idle		0 MPa {0 kg/cm ² }

- 5) After finishing measurement, remove the measuring instruments and return the removed parts.

Adjusting

★ If the following phenomena occur and PC valve (5) seems to be defective, adjust PC valve (5) according to the procedure shown below.

- When the working load is increased, the engine speed lowers largely.
- The engine speed is normal but the working speed is low.



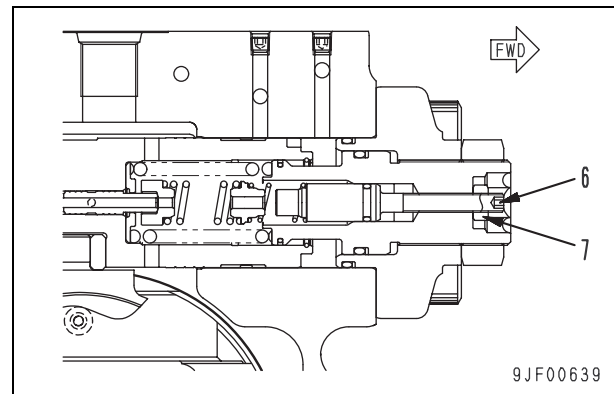
1. Loosen locknut (7).
 - ★ The width across flats of the PC valve locknut is 13 mm and that (inside width) of the adjusting screw is 4 mm. All the locknuts and adjusting screws other than them affect the hydraulic pump performance. Accordingly, do not turn any of them.
 - ★ Before loosening the locknut, make match marks at the end of the adjusting screw so that you can see the position of the adjusting screw before adjustment (and you can return the adjusting screw to that position).

2. Turn the adjusting screw (6) to the right or left.
 - ★ Turn the adjusting screw in the following directions.
 - If the work equipment speed is low, turn the adjusting screw to the right (to increase the pump absorption torque).
 - If the engine speed is low, turn the adjusting screw to the left (to decrease the pump absorption torque).

3. Tighten locknut (7).

Lock nut:

27.5 – 34.3 Nm {2.8 – 3.5 kgm}



4. After finishing adjustment, check that the PC valve output pressure (servo piston inlet pressure) is normal according to the procedure for measurement described above.

Inspection and adjustment of pump LS control circuit oil pressure

- ★ Inspecting and adjusting instruments for pump LS control circuit

Symbol	Part No.	Part name
N	1	799-101-5002 Hydraulic tester
		790-261-1204 Digital hydraulic tester
	2	799-101-5220 Nipple (10 x 1.25 mm)
		07002-11023 O-ring
	3	799-401-2701 Differential pressure gauge

Measurement

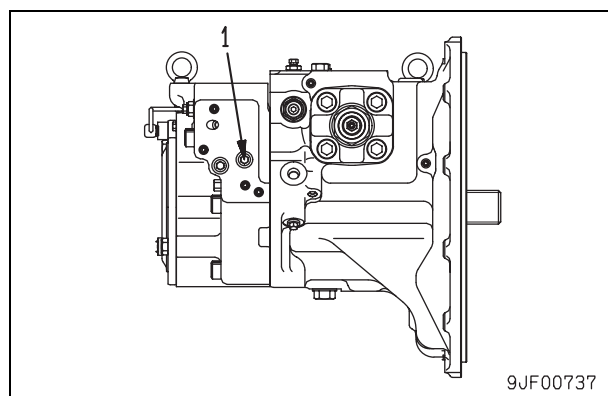
- ★ Before measuring the pump LS control circuit oil pressure, check that the work equipment, swing and travel circuit oil pressures are normal.

⚠ Lower the work equipment to the ground and stop the engine. Operate the control lever several times to release the residual pressure from the piping, and then loosen the oil filler cap of the hydraulic tank slowly to release the residual pressure from the tank.

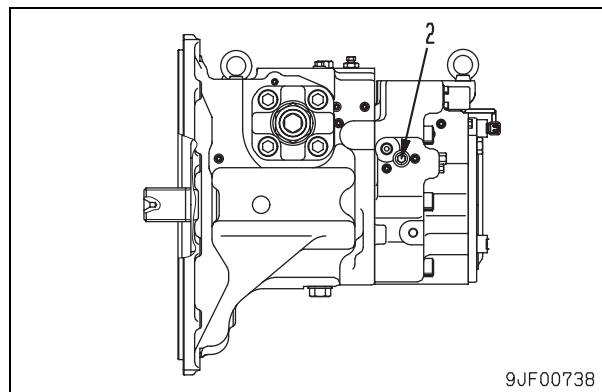
1. Measurement of LS valve output pressure (Servo piston inlet pressure)

- ★ Measure the LS valve output pressure (servo piston inlet pressure) and pump discharge pressure (both F and R) simultaneously and compare them with each other.

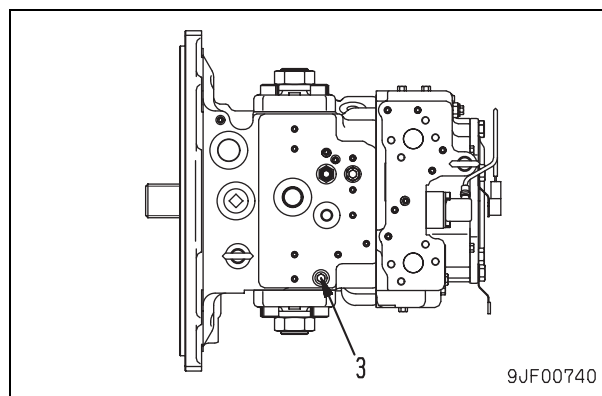
- Remove oil pressure pickup plugs (1), (2), and (3).
 - (1): Front pump discharge pressure pickup plug (PA1)



- (2): Rear pump discharge pressure pickup plug (PA2)

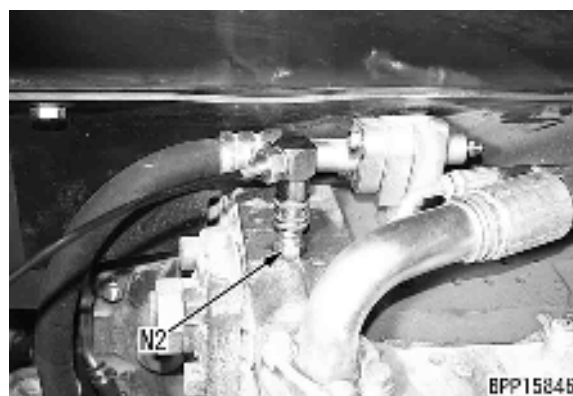


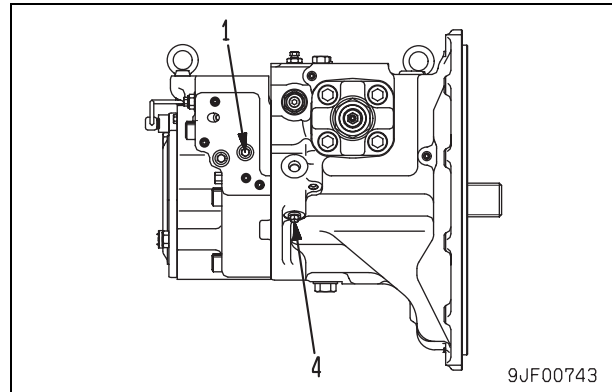
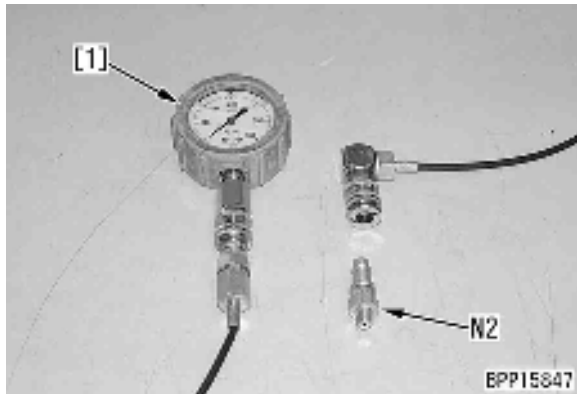
- (3): LS valve output pressure pickup plug



- Install nipple **N2** and connect oil pressure gauge [1] of hydraulic tester **N1**.

- ★ Use the oil pressure gauge of 58.8 MPa {600 kg/cm²}.
- ★ The measuring instruments installed to the LS valve output pressure pickup port are shown in the figure.





- 3) Run the engine and heighten the hydraulic oil temperature to the operating range.
- 4) Run the engine at high idle under the following condition and measure the pump discharge pressures (both F and R) and LS valve output pressure (servo piston inlet pressure) simultaneously.

- Working mode: P
- Measure with all of work equipment, swing, and travel levers in neutral and with the bucket curled (the bucket lever at stroke end).

★ Judging method

If the ratio of the pump discharge pressure (higher one of F and R) to the LS valve output pressure (servo piston inlet pressure) is as follows, those pressures are normal.

Measured oil pressure	When in neutral	When bucket is curled
Pump discharge pressure	Almost same pressure	1
LS valve output pressure		Approx. 0.6 (Approx. 3/5)

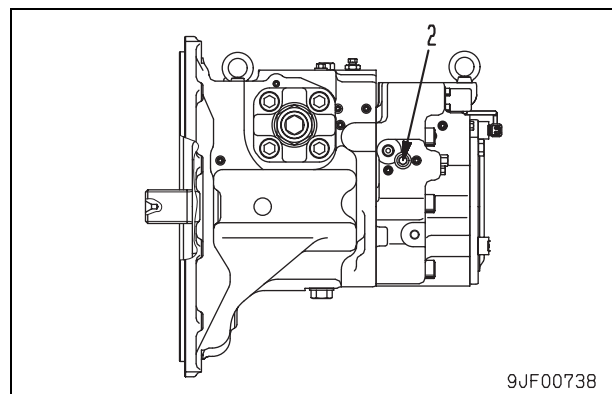
- 5) After finishing measurement, remove the measuring instruments and return the removed parts.

2. Measurement of LS differential pressure

- ★ Measure the pump discharge pressure (either of F and R) and LS pressure (actuator load pressure) simultaneously and calculate the difference between them and use the result as the LS differential pressure.

- 1) Remove oil pressure pickup plugs (1), (2), and (4).
 - (1): Front pump discharge pressure pickup plug (PA1)
 - (4): LS pressure pickup plug

- (2): Rear pump discharge pressure pickup plug (PA2)



- 2) Install nipple **N2** and connect it to differential pressure gauge **N3** or oil pressure gauge [2] of hydraulic tester **N1**.

- ★ The measuring instruments installed to the LS pressure pickup plug are shown in the figure.

- ★ When using the differential pressure gauge:

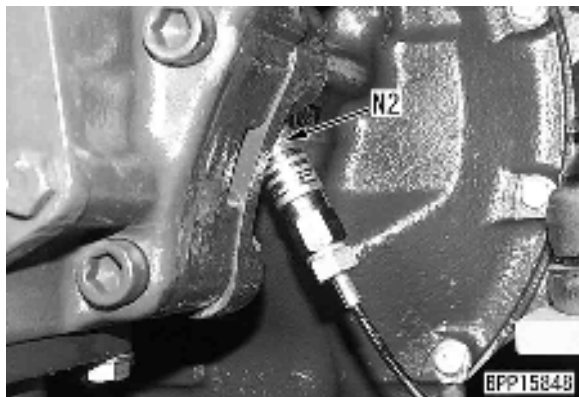
Connect the pump pressure (either of F and R) to the high pressure side (back side) and connect the LS pressure to the low pressure side (lower side). Since the differential pressure gauge needs a 12V power source, connect it to a battery.

- ★ When using oil pressure gauge:

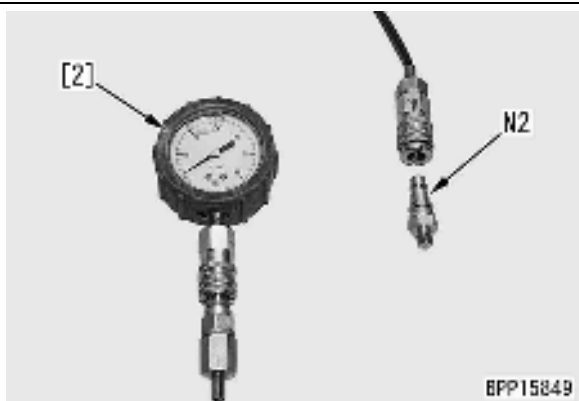
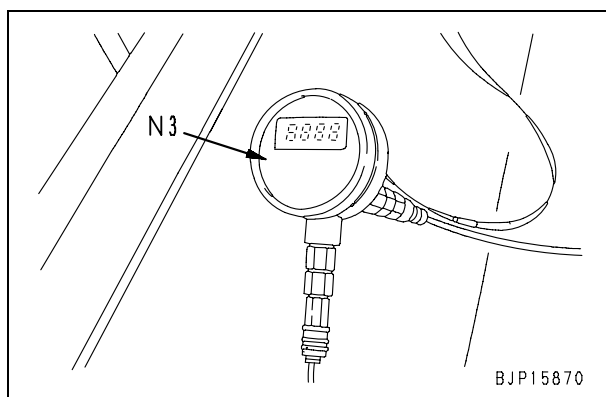
Use the oil pressure gauge of 58.8 MPa {600 kg/cm²}.

Since the differential pressure is about 2.5 MPa {25 kg/cm²} at maximum, measure it by installing the same gauge to the pickup plugs alternately.

- The figure shows the LS pressure side.



- 3) Run the engine and heighten the hydraulic oil temperature to the operating range.



- 4) Run the engine at high idle under the following condition and measure the pump discharge pressures (either of F and R) and LS pressure (actuator load pressure) simultaneously.

- Working mode: P
- Measure when all of work equipment, swing, and travel levers are in neutral and when the bucket is curled (the bucket lever is at stroke end).
- ★ Calculation of LS differential pressure (When oil pressure gauge is used):

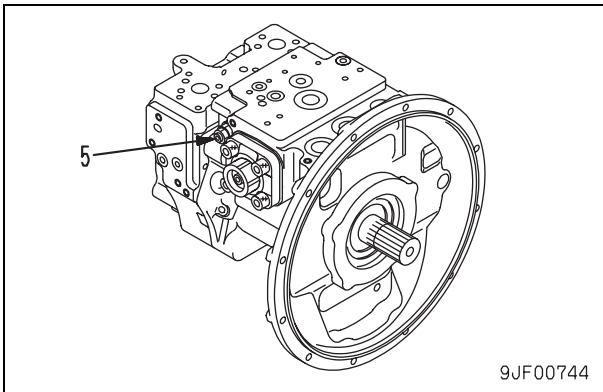
$$\text{LS differential pressure} = \text{Pump pressure} - \text{LS pressure}$$
- ★ If the LS differential pressure is as follows, it is normal.

Operation of lever	LS differential pressure
When all levers are in neutral	Unload pressure (See standard value)
When bucket is curled (lever is at stroke end)	Standard LS differential pressure (See standard value)

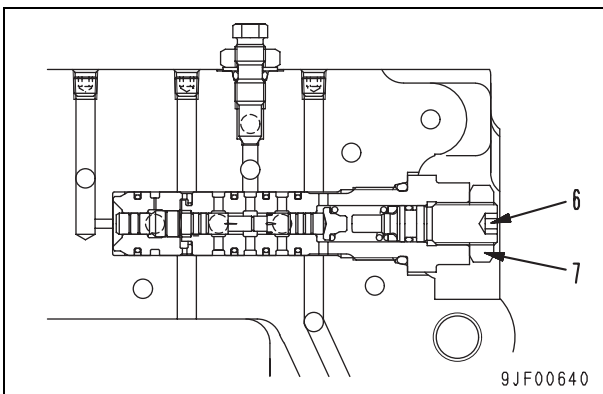
- 5) After finishing measurement, remove the measuring instruments and return the removed parts.

Adjustment

- ★ If the LS differential pressure is abnormal, adjust LS valve (5) according to the following procedure.



1. Fixing adjusting screw (6), loosen locknut (7).
2. Turn adjusting screw (6) to adjust the LS differential pressure.
 - ★ If the adjusting screw is
 - Turned to the right, the differential pressure rises.
 - Turned to the left, the differential pressure lowers.
 - ★ Quantity of adjustment per turn of adjusting screw: Approx. 1.3 MPa {Approx. 13.3 kg/cm²}
3. Fixing adjusting screw (6), tighten locknut (7).
 Lock nut: **49 – 64 Nm {5 – 7 kgm}**



4. After finishing adjustment, check again that the LS differential pressure is normal according to the procedure for measurement described above.

Measurement of solenoid valve output pressure

- ★ Measuring instruments for solenoid valve output pressure

Symbol	Part No.	Part name
P	1	799-101-5002 Hydraulic tester
		790-261-1204 Digital hydraulic tester
	2	799-401-3100 Adapter (Size: 02)
		799-401-3200 Adapter (Size: 03)

- ★ Before measuring the solenoid valve output pressure, check that the control circuit basic pressure is normal.

⚠ Lower the work equipment to the ground and stop the engine. Operate the control lever several times to release the residual pressure from the piping, and then loosen the oil filler cap of the hydraulic tank slowly to release the residual pressure from the tank.

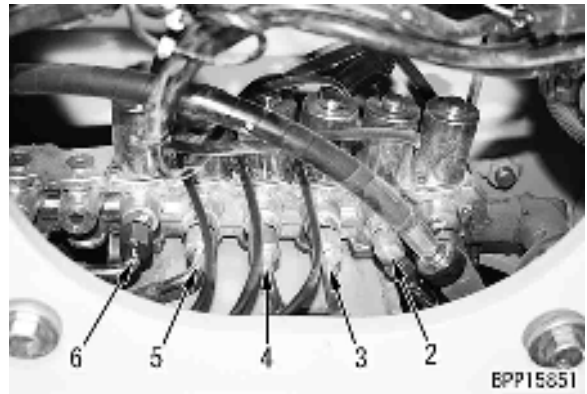
1. Disconnect hoses (1) – (6) of the solenoid valves to be measured.

No.	Solenoid valve to be measured
1	PPC lock solenoid valve
2	2-stage relief solenoid valve
3	Swing holding brake solenoid valve
4	Travel speed selector solenoid valve
5	Travel junction solenoid valve
6	Pump merge-divider solenoid valve

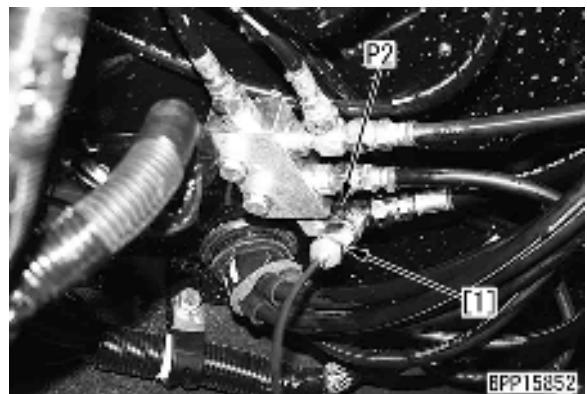
- ★ Since hose (1) is installed under the cab, remove the cab undercover (rear one).



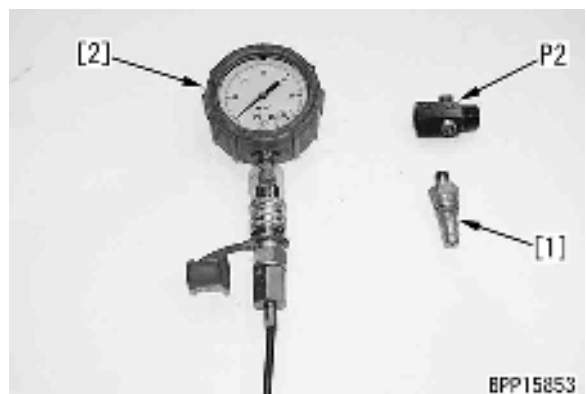
- ★ Since hoses (2) – (6) are installed under the control valve, remove the control valve undercover.



2. Install adapter **P2** and connect the disconnected hoses again.
3. Install nipple [1] of hydraulic tester P1 and connect it to oil pressure gauge [2].
- ★ Use the oil pressure gauge of 5.9 MPa {60 kg/cm²}.
 - ★ The measuring instruments installed to the outlet hose of the PPC lock solenoid valve are shown in the figure.



4. Run the engine and heighten the hydraulic oil temperature to the operating range.



5. Run the engine at high idle and operate the control levers and switches and measure the pressure when each solenoid valve is turned ON or OFF.
 - ★ For the conditions for turning each solenoid valve ON and OFF, see the table for functioning conditions of each solenoid valve.
 - ★ The operating conditions of the solenoid valves can be checked with the monitoring function of the machine monitor (special function of the machine monitor).
 - ★ If the output pressure of a solenoid valve is as follows, that solenoid valve is normal.

Solenoid valve	Output pressure
OFF (Demagnetized)	0 MPa {0 kg/cm ² }
ON (Magnetized)	Almost same as control basic pressure (See standard values table)

6. After finishing measurement, remove the measuring instruments and return the removed parts.

Table for functioning conditions - PPC lock solenoid valve

Operating condition		Functioning
Work equipment lock lever	LOCK	OFF
	RESET	ON

Table for functioning conditions - 2-stage relief solenoid valve

Functioning condition			Functioning
When overheat setting of the 1st stage is ON			OFF
When overheat setting of the 2nd stage is ON			
When all the signals for work equipment, swing and travel are OFF			
When swing lock switch is ON			ON
When travel signal is ON			
When working mode is L mode			
When boom LOWER signal is ON			
When working mode is P or E mode	When left knob switch is ON	If signals other than swing operation only is ON	OFF
		If swing operation only is ON	
In conditions other than above			

Table for functioning conditions - travel speed shifting solenoid valve

Functioning condition			Functioning
When overheat setting of the 2nd stage is ON			OFF
When the fuel dial indicates less than 1500 rpm			
When the travel speed switch is at Lo			
When the travel speed switch is at Hi	The travel signal is OFF		
	The travel signal is ON	If front or rear pump pressure is 29.4 MPa {300 kg/cm²}	
		If front or rear pump pressure is 15.3 MPa {156 kg/cm²}	
In conditions other than above			ON

Table for functioning conditions - swing holding brake solenoid

Functioning condition		Functioning
Work equipment, swing, travel, signalling	When all of them is OFF	OFF
	When any of them is ON	ON

Table for functioning conditions - travel junction solenoid valve

Functioning condition		Functioning
When the travel signal is ON	When machine travels without operating any work equipment (When work equipment, swing, and/or service signals are OFF)	ON
	When machine travels and operates work equipment simultaneously (When work equipment, swing, and/or service signals are ON)	OFF
When the travel signal is OFF		

Table for functioning conditions - merge/divide solenoid valve

Functioning condition		Functioning
When travel signal is ON	When machine travels without operating any work equipment (When work equipment, swing, and/or service signals are OFF)	ON
	When machine travels and operates work equipment simultaneously (When work equipment, swing, and/or service signals are ON)	OFF
When travel signal is OFF		

Measurement of PPC valve output pressure

★ PPC valve output pressure measurement tools

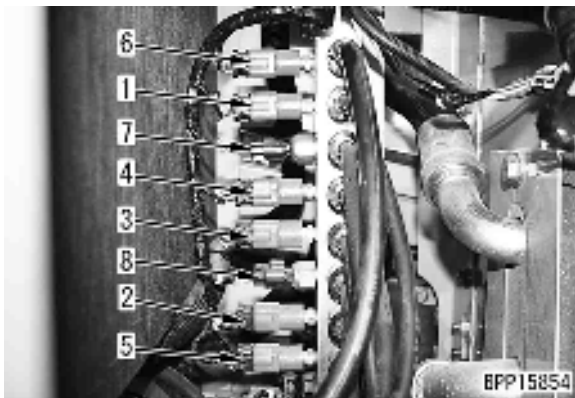
Symbol	Part No.	Part name
Q	799-101-5002	Hydraulic tester
	790-261-1204	Digital hydraulic tester

★ Measure PPC valve output pressure after confirming that control circuit original pressure is normal.

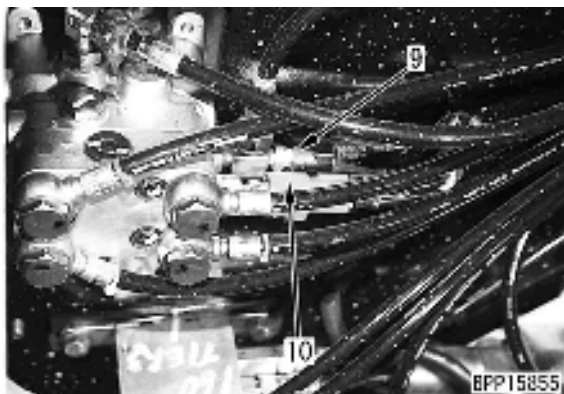
1. Remove PPC oil pressure switches (1) through (10) in the hydraulic circuits to be measured. Connector numbers are shown in brackets ().

No.	Circuit to be measured	No.	Circuit to be measured
1	Boom, RAISE (P06)	7	Swing, left (P03)
2	Boom, LOWER (P02)	8	Swing, right (P07)
3	Arm, IN (P04)	9	Travel (black) (P09)
4	Arm, OUT (P08)	10	Steering (red) (P10)
5	Bucket, CURL (P01)		
6	Bucket, DUMP (P05)		

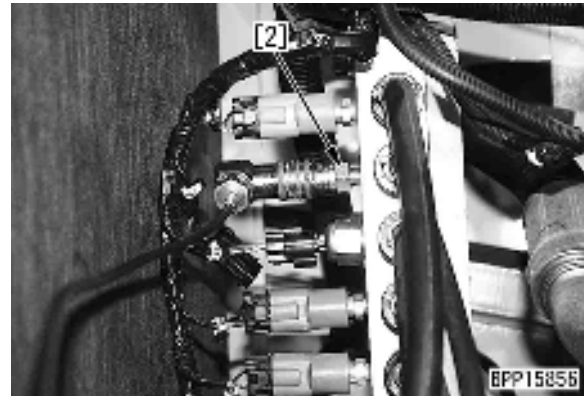
★ (1) – (8) are installed to the PPC junction block in the rear of the cab.



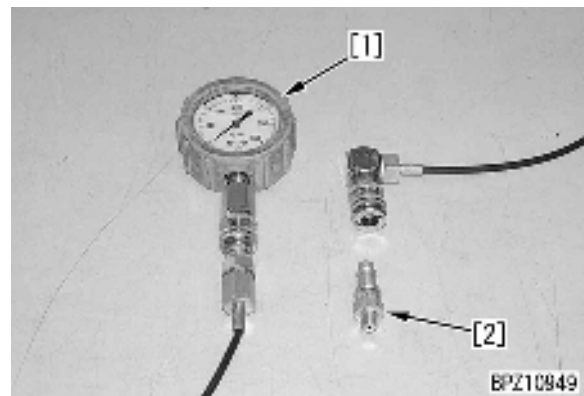
★ Since (9) and (10) are installed under the cab, remove cab undercover (front one).



2. Fit fitting [2] of hydraulic tester **Q** and connect oil pressure gauge [1].
 - ★ Use an oil pressure gauge with the capacity of 5.9 MPa {60 kg/cm²}.
 - ★ The measuring instruments installed to the mounting part of the boom RAISE PPC oil pressure switch are shown in the figure.



3. Start the engine and keep it running until the hydraulic oil temperature rises to the operating range.
 - ★ Turn OFF the auto-decelerator switch.



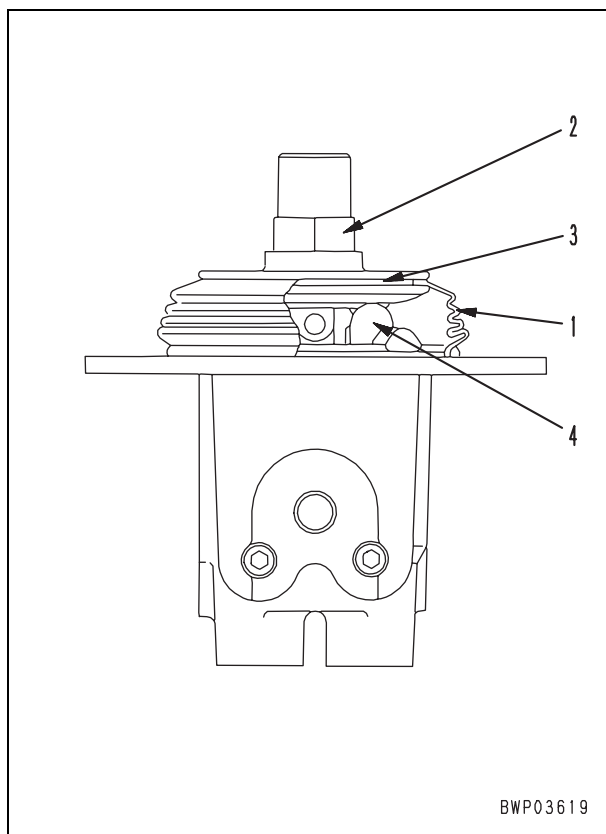
4. Measure the pressure when the engine is running at high idle and the control lever of the circuit to be measured is kept in the NEUTRAL position and at the full stroke.
 - ★ If PPC valve output pressure is at the level shown below, it is judged normal.

Lever control	Hydraulic pressure
In NEUTRAL	0 MPa {0 kg/cm ² }
At full stroke	Nearly equal to control original pressure (See standard value table)

5. Detach all the measurement tools, and make sure that the machine is back to normal condition.

Adjustment of work equipment and swing PPC valve

- ★ If the work equipment/swing lever has large play, adjust the PPC valve according to the following procedure.
1. Remove work equipment and swing PPC valve assembly.
 2. Take off boot (1).
 3. Loosen lock nut (2) and screw in disc (3) until it contacts the heads of four pistons (4).
 - ★ Do not move the piston while doing this work.
 4. Keep disc (3) in place and tighten lock nut (2) to the specified tightening torque.
🔧 Lock nut: **98 – 127 Nm {10 – 13 kgm}**
 5. Install boot (1).
 6. Install work equipment and swing PPC valve ass'y.



Measuring and adjusting quick coupler control valve output pressure

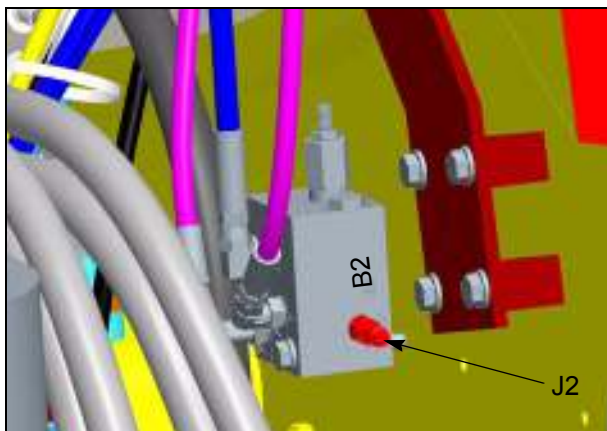
- ★ Measuring and adjusting tools for oil pressure in quick coupler circuit.

Symbol	Part No.	Part name
J	1	799-101-5002 Hydraulic tester
		790-261-1204 Digital hydraulic tester
	2	799-101-5220 Nipple (10 × 1.25 mm)
		07002-11023 O-ring

⚠ Stop the machine on a level ground and lower the work equipment to the ground. Then, release the residual pressure from the hydraulic circuit. For details, see "Releasing residual pressure from hydraulic circuit".

Measuring

- Measure quick coupler control valve output pressure after checking that work equipment, swing and travel circuit pressures are normal.
- Fit nipple J2 to port B2 and connect it to oil pressure gauge of hydraulic tester.



- Use an oil pressure gauge with the capacity of 59MPa (600kg/cm²)
- Start the engine. In order to raise the pressure to the set pressure of the pressure regulating valve it will be necessary to operate one of the main control circuits (bucket, boom, arm or swing). If using swing circuit set the swing lock to ON.

NOTE: When delivered from the factory the regulated pressure is set to 4MPa (41kg/cm²).

Adjustment

If the regulated pressure is not suitable for the quick coupler to be installed adjust the pressure of the regulating valve as follows:

1. Loosen the locknut (1a). (using a 17mm spanner).



2. Turn the adjustment screw (1b) to adjust the pressure. (Using a 5mm hexagon key).
 - If the screw is turned to the right the pressure increases.
 - If the screw is turned to the left the pressure reduces.
 - Quantity of adjustment per turn of the screw: Approx 5.5MPa.



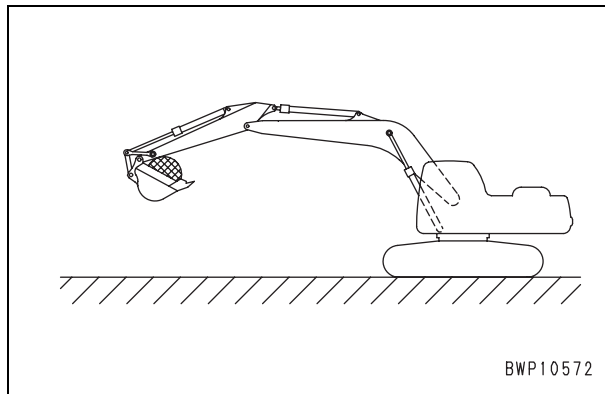
3. After required pressure is achieved, hold adjustment screw (1b) and tighten the lock nut (1a). (Torque of lock nut (1a) 12+/-2Nm)

Inspection of locations of hydraulic drift of work equipment

- ★ If there is any hydraulic drift in the work equipment (cylinders), check in the following manner to determine if the cause is in the cylinder packing or in the control valve.

1. Measurement of boom and bucket cylinders

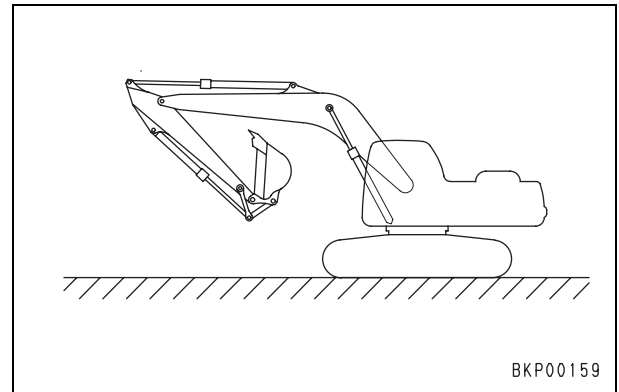
- 1) Set the work equipment in the same posture as when measuring hydraulic drift, and stop the engine.
 - ★ Fill the bucket with earth or apply the rated load to the bucket.



- 2) Operate the control lever to the RAISE position or the bucket control lever to the CURL position.
 - If the lowering speed increases, the cylinder piston ring is defective.
 - If there is no change, the control valve is defective.
 - ★ Operate the control lever with the engine starting switch in the ON position.
 - ★ If the pressure in the accumulator of the PPC circuit is low, heighten it by running the engine for about 10 seconds.

2. Inspection of arm cylinder

- 1) Operate the arm cylinder to move the arm to the position 100 mm before the digging stroke end, and stop the engine.



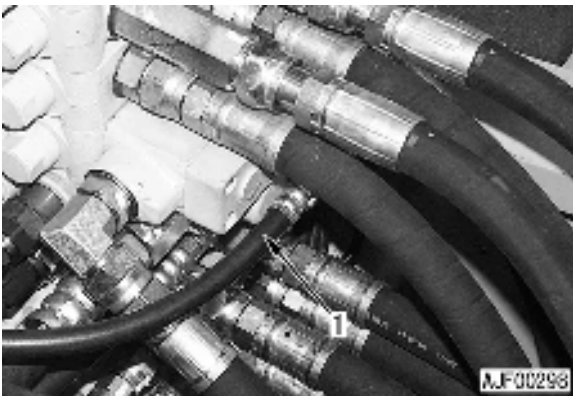
- 2) Operate the arm control lever to move the arm to the digging side.
 - If the lowering speed increases, the cylinder piston ring is defective.
 - If there is no change, the control valve is defective.
 - ★ Operate the control lever with the engine starting switch in the ON position.
 - ★ If the pressure in the accumulator of the PPC circuit is low, heighten it by running the engine for about 10 seconds.

[Reference] If the cause of the hydraulic drift is in the defective piston ring, and the above operation is carried out, downward movement is accelerated for the following reasons.

- 1) If the work equipment is set to the above posture (holding pressure applied to the bottom end), the oil at the bottom end leaks to the head end. However, the volume at the head end is small than the volume at the bottom end by the volume of the rod end, so the internal pressure at the head end increases because of the oil flowing in from the bottom end.
- 2) When the internal pressure at the head end increases, the pressure at the bottom end also rises in proportion to this. The balance is maintained at a certain pressure (this differs according to the amount of leakage) by repeating this procedure.
- 3) When the pressure is balanced, the downward movement becomes slower. If the lever is then operated according to the procedure given above, the circuit at the head end is opened to the drain circuit (the bottom end is closed by the pressure compensation valve), so the oil at the head end flows to the drain circuit and the downward movement becomes faster.

3. Inspection of boom lock valve

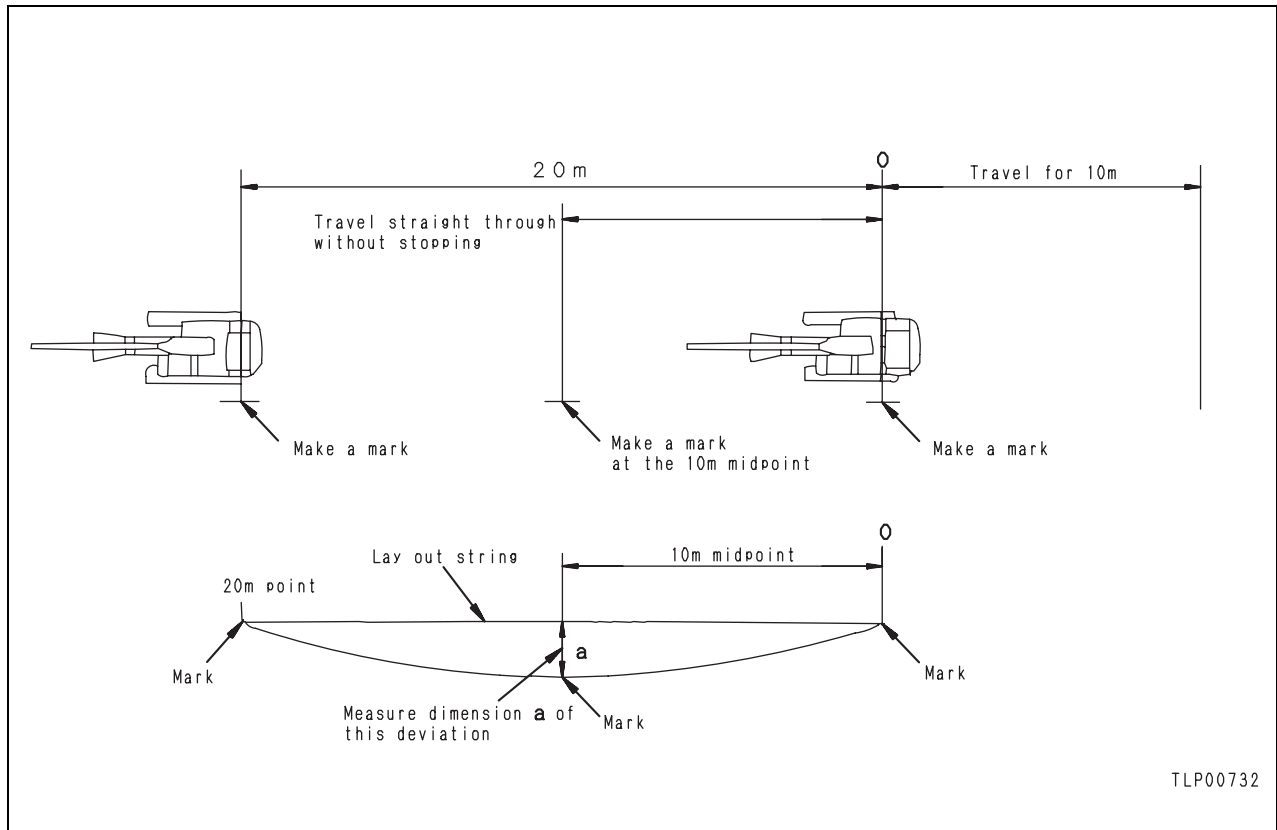
- 1) Set the work equipment at the maximum reach and the boom top horizontal. Then stop the engine.
 - ⚠ **Lock the work equipment control levers and release the pressure inside the hydraulic tank.**
 - ⚠ **Do not allow anyone to come under the work equipment during the work.**
- 2) Disconnect drain hose (1) of the control valve and plug it.
 - Part No. for the blind hose:
07376-70315
 - ★ Leave the control valve end open.
 - ★ If any oil leaks out from the port that is left open, following hydraulic drift of the work equipment, the boom lock valve is defective (loose contact).



4. Inspection of PPC valve

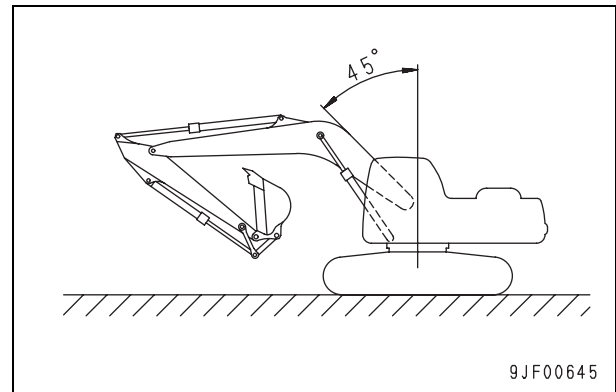
- 1) Set the work equipment at the maximum reach with the boom top in level and stop the engine.
- 2) Heighten the pressure in the PPC accumulator and set the work equipment lock lever in the LOCK/FREE position and measure the hydraulic drift of the work equipment.
 - ★ Operate the work equipment lock lever while the starting switch is in the ON position.
 - ★ If the pressure in the accumulator of the PPC circuit is low, heighten it by running the engine for about 10 seconds.
 - ★ If there is any difference in the hydraulic drift between LOCK and FREE positions, the PPC valve is defective (some internal failure).

Testing and adjusting travel deviation



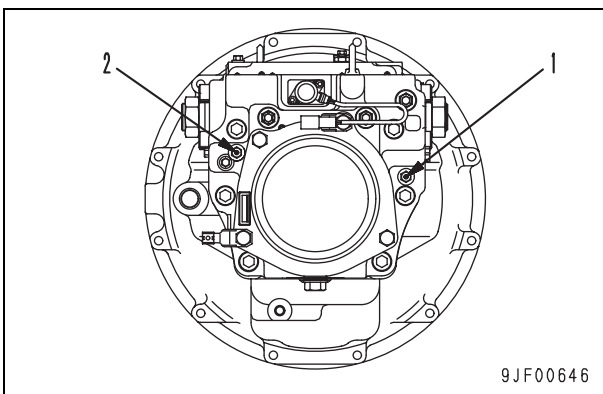
Inspection

- Run the engine and heighten the hydraulic oil temperature to the operating range and set the machine in the travel posture.
 - ★ To set the machine in the travel posture, extract the bucket cylinder and arm cylinder fully and set the boom angle to 45°.
- Set the working mode to P and travel speed to Lo.
- Run up for 10 m with the engine speed at high idle and continue travel under the same condition for 20 m and measure the deviation (a).
 - ★ Install an oil pressure gauge and check that the F and R discharge pressures of the hydraulic pump are even.

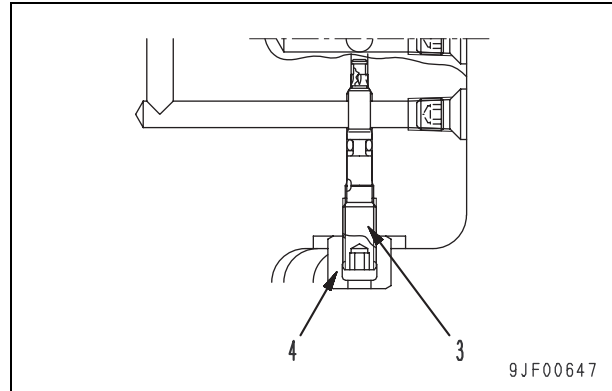


Adjustment

- ★ If the machine deviates, it can be corrected by partially draining the oil discharged more from the pump through the travel deviation adjusting plug. (If the travel deviation is corrected by this method, however, the pump discharge is reduced. As a result, the travel speed, work equipment speed in compound operation, and relief pressure may lower.)
 - ★ If the machine deviates in the same direction regardless of the travel direction, correct it according to the following procedure. (If the deviating direction of the machine depends on the travel direction, the cause of deviation may not be in the hydraulic pump. In this case, carry out troubleshooting.)
 - ★ Only when the travel deviation is 200 mm or less, it can be corrected by the following method.
 - ⚠ **If the adjusting plug is loosened more than the adjustment limit, high-pressure oil will spout out. Take care extremely.**
 - ⚠ **Lower the work equipment to the ground and stop the engine. Operate the control lever several times to release the residual pressure from the piping, and then loosen the oil filler cap of the hydraulic tank slowly to release the residual pressure from the tank.**
1. Check the deviating direction and the locations of travel deviation adjusting plugs (1) and (2).
 - (1): Right deviation adjusting plug (F pump)
 - (2): Left deviation adjusting plug (R pump)
 - ★ Loosen only the plug on either side for adjustment. Do not loosen the plugs on both sides.



2. Fixing plug (3) with a hexagonal wrench (Width across flats: 4 mm), loosen locknut (4).
 - ★ If the locknut is sealed with a vinyl tape, remove that tape.
 - ★ Before loosening the locknut, make match marks on it and pump case.
 - Loosening angle of locknut: Approx. 90 – 180°



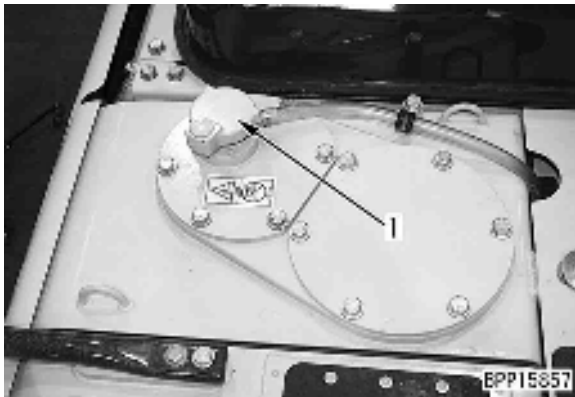
3. Loosen plug (3) to adjust the travel deviation.
 - Quantity of adjustment of deviation per turn of plug: 150 mm (Reference)
 - ★ The plug is fully tightened when shipped. Adjust the deviation by the loosening angle of the plug from the fully tightened position.
 - ★ If the plug is turned together with the locknut, tighten it fully again, then start adjustment.
 - ★ The plug can be loosened by 2 turns (720°) from the fully tightened position.
4. Fixing plug (3) with a hexagonal wrench, tighten locknut (4).
 - ⚙ Locknut: **2.9 – 4.9 Nm {0.3 – 0.5 kgm}**
 - ★ After tightening the locknut, seal its hole with a vinyl tape.
5. After finishing adjustment, check travel deviation again according to the procedure for inspection described above.

Release of residual pressure from hydraulic circuit

1. Release of residual pressure from hydraulic tank

⚠ The hydraulic tank is enclosed and pressurized. When removing a hose or a plug connected to the hydraulic tank, release the residual pressure from the hydraulic tank according to the following procedure.

- 1) Lower the work equipment to the ground in a stable posture and stop the engine.
- 2) Slowly loosen oil filler cap (1) of the hydraulic tank to release the air from the tank.



2. Release of residual pressure from hydraulic cylinder circuit

⚠ When disconnecting the piping between a hydraulic cylinder and the control valve, release the residual pressure from the piping according to the following procedure.

- 1) Referring to 1. Release of residual pressure from hydraulic tank, release the residual pressure from the hydraulic tank.
 - ★ Leave the oil filler cap of the hydraulic tank removed.
- 2) Turn the starting switch to the ON position and set the work equipment lock lever in the FREE position, and then operate the work equipment control levers on both sides forward, backward, to the right, and to the left.
 - ★ The control valve is driven with the pressure in the accumulator. If it is operated 2 – 3 times, the pressure lowers.
- 3) Start the engine and run it at low idle for 5 seconds to heighten the pressure in the accumulator.
- 4) Repeat above steps 2) and 3) 2 – 3 times, and all residual pressure is released from the piping.

3. Release of residual pressure from swing motor circuit

- ★ Release the residual pressure from the swing motor circuit by performing the procedure for 2. release of residual pressure from hydraulic cylinder circuit.

4. Release of residual pressure from travel motor circuit

- ★ Since the control valve spool of the travel motor is open, release the residual pressure from the travel motor circuit by performing the procedure for 1. Release of residual pressure from hydraulic tank.

Measurement of oil leakage

★ Measuring instruments for oil leakage

Symbol	Part No.	Part name
R	Commercially available	Measuring cylinder

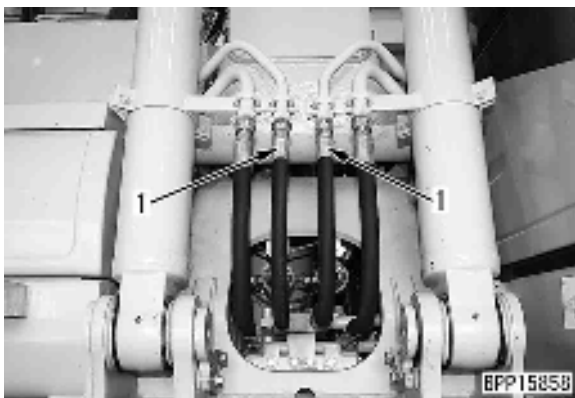
1. Measurement of leakage from boom cylinder

- 1) Run the engine and heighten the hydraulic oil temperature to the operating range and raise the boom to the stroke end.

⚠ **Referring to Release of residual pressure from hydraulic circuit, release the residual pressure from the piping on the boom cylinder head side (Operate the lever only in the RAISE direction, however).**

- 2) Disconnect hoses (1) on the cylinder head side and block it with a plate.

⚠ **Take care not to disconnect the hose on the cylinder bottom side.**



- 3) Run the engine at high idle and relieve the boom cylinder by operating the boom control lever in the RAISE direction

⚠ **Take care not to operate the boom control lever in the LOWER direction.**

- 4) Start measuring the oil leakage 30 seconds after the boom cylinder is relieved and measure for 1 minute.
- 5) After finishing measurement, return the parts.

2. Measurement of leakage from arm cylinder

- 1) Run the engine and heighten the hydraulic oil temperature to the operating range and move in the arm to the stroke end.

⚠ **Referring to Release of residual pressure from hydraulic circuit, release the residual pressure from the piping on the arm cylinder head side (Operate the lever only in the IN direction, however).**

- 2) Disconnect hose (2) on the cylinder head side and block it with a plate.

⚠ **Take care not to disconnect the hose on the cylinder bottom side.**



- 3) Run the engine at high idle and relieve the arm cylinder by operating the arm control lever in the IN direction

⚠ **Take care not to operate the arm control lever in the OUT direction.**

- 4) Start measuring the oil leakage 30 seconds after the arm cylinder is relieved and measure for 1 minute.
- 5) After finishing measurement, return the parts.

3. Measurement of leakage from bucket cylinder

- 1) Run the engine and heighten the hydraulic oil temperature to the operating range and curl the bucket to the stroke end.

⚠ **Referring to Release of residual pressure from hydraulic circuit, release the residual pressure from the piping on the bucket cylinder head side (Operate the lever only in the CURL direction, however).**

- 2) Disconnect hose (3) on the cylinder head side and block it with a plate.

⚠ **Take care not to disconnect the hose on the cylinder bottom side.**



- 3) Run the engine at high idle and relieve the bucket cylinder by operating the bucket control lever in the CURL direction

⚠ Take care not to operate the bucket control lever in the DUMP direction.

- 4) Start measuring the oil leakage 30 seconds after the bucket cylinder is relieved and measure for 1 minute.
- 5) After finishing measurement, return the parts.

4. Measurement of leakage from swing motor

- 1) Disconnect drain hose (4) and plug it.

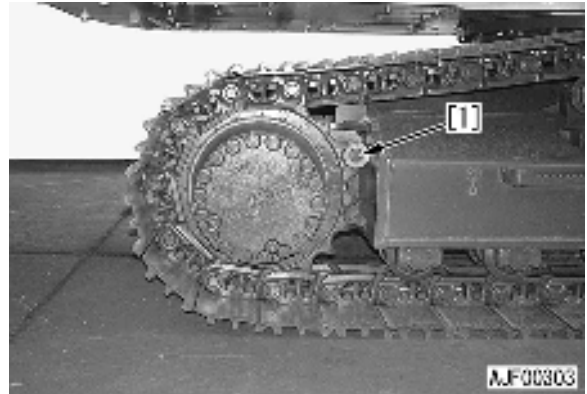


- 2) Turn the swing lock switch ON.
- 3) Run the engine at high idle and relieve the swing circuit and measure the oil leakage.
 - ★ Start measuring the oil leakage 30 seconds after the swing motor circuit is relieved and measure for 1 minute.
 - ★ After measuring 1 time, swing the upper structure 180° and measure again.
- 4) After finishing measurement, return the parts.

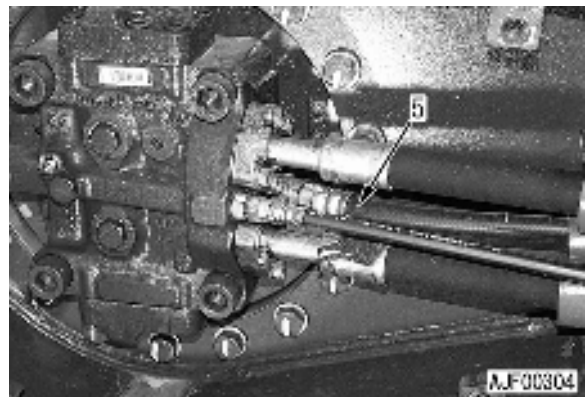
5. Measurement of leakage from travel motor

- 1) Remove the travel motor cover.
- 2) Start the engine and lock the travel mechanism.

⚠ Set pin [1] between the sprocket and track frame to lock the travel mechanism securely.



- 3) Disconnect drain hose (5) of the travel motor and plug it.



- 4) Run the engine at high idle and relieve the travel circuit and measure the oil leakage.
 - ⚠ Since wrong operation of the levers can cause an accident, make signs and confirmation securely.**
 - ★ Start measuring the oil leakage 30 seconds after the swing motor circuit is relieved and measure for 1 minute.
 - ★ Measure the oil leakage several times, moving the motor little by little (changing the positions of the valve plate and cylinder and those of the cylinder and piston).
- 5) After finishing measurement, return the parts.

Bleeding air from each part

Air bleeding item Contents of work	Air bleeding procedure					
	1	2	3	4	5	6
	Bleeding air from hydraulic pump	Starting engine	Bleeding air from cylinder	Bleeding air from swing motor	Bleeding air from travel motor	Checking oil level and starting work
<ul style="list-style-type: none"> Replacement of hydraulic oil Cleaning of strainer 	●	●	●	● (See note)	● (See note)	●
<ul style="list-style-type: none"> Replacement of return filter element 		●	→	→	→	●
<ul style="list-style-type: none"> Replacement or repair of hydraulic pump Removal of suction piping 	●	●	●	→	→	●
<ul style="list-style-type: none"> Replacement or repair of control valve Removal of control valve piping 		●	●	→	→	●
<ul style="list-style-type: none"> Replacement or repair of cylinder Removal of cylinder piping 		●	●	→	→	●
<ul style="list-style-type: none"> Replacement or repair of swing motor Removal of swing motor piping 		●	→	●	→	●
<ul style="list-style-type: none"> Replacement or repair of travel motor Removal of travel motor piping 		●	→	→	●	●

★ Bleed air from the swing motor and travel motor only when the oil was drained from the motor cases.

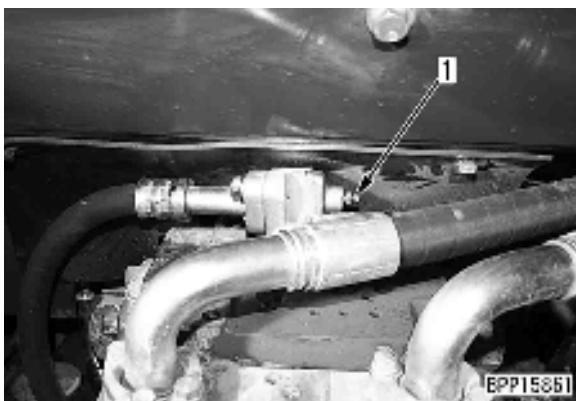
1. Bleeding air from hydraulic pump

- ★ Keep the oil filler cap of the hydraulic tank loosened while the air is bled from the hydraulic pump.

- Loosen air bleeder (1) and check that oil oozes out from it.
- After oil containing no bubbles flows out, tighten air bleeder (1).

☞ Air bleeder:

27.5 – 35.3 Nm {2.8 – 3.6 kgm}



2. Starting engine

When running the engine after performing step 1, keep its speed at low idle.

- ★ If the engine coolant temperature is low and the automatic warm-up operation is started, stop the engine temporarily and reset the automatic warm-up operation with the fuel control dial (Set the starting switch in the ON position and hold the fuel control dial in the MAX position for 3 seconds, and the automatic warm-up operation is reset).

3. Bleeding air from cylinder

- ★ If a cylinder was replaced, bleed air from it before connecting the work equipment. In particular, the boom cylinder does not move to the lowering stroke end, if it is installed to the work equipment.

- Run the engine at low idle for about 5 minutes.
- Running the engine at low idle, raise and lower the boom 4 – 5 times.
 - ★ Stop the piston rod about 100 mm before each stroke end. Do not relieve the oil.
- Running the engine at high idle, perform step 2).
- Running the engine at low idle, move the piston rod to the stroke end and relieve the oil.
- Bleed air from the arm cylinder and bucket cylinder according to steps 2) – 4).

4. Bleeding air from swing motor

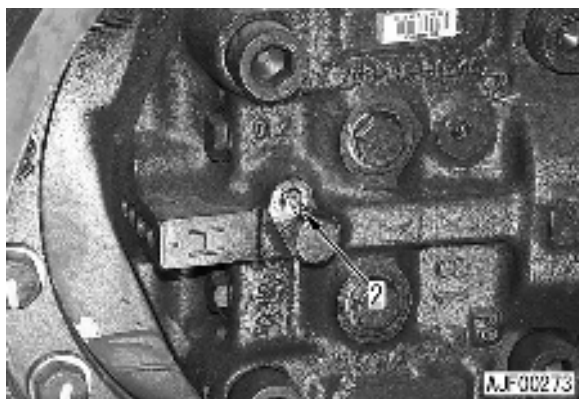
- 1) Run the engine at low idle.
- 2) Swing to the right and left slowly to bleed air.

5. Bleeding air from travel motor

- 1) Run the engine at low idle.
- 2) Loosen air bleeder (2) and check that oil oozes out from it.
- 3) After oil containing no bubbles flows out, tighten air bleeder (2).

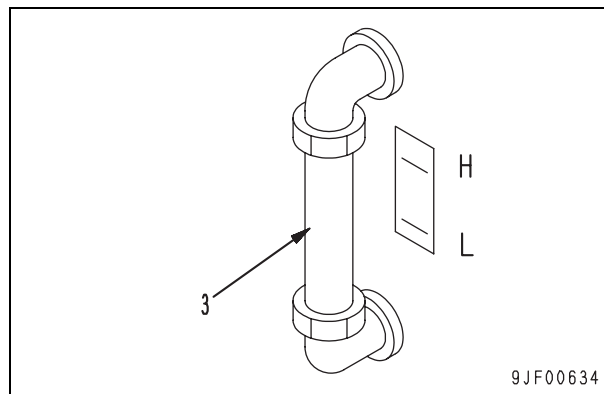
 Air bleeder:

27.5 – 35.3 Nm {2.8 – 3.6 kgm}

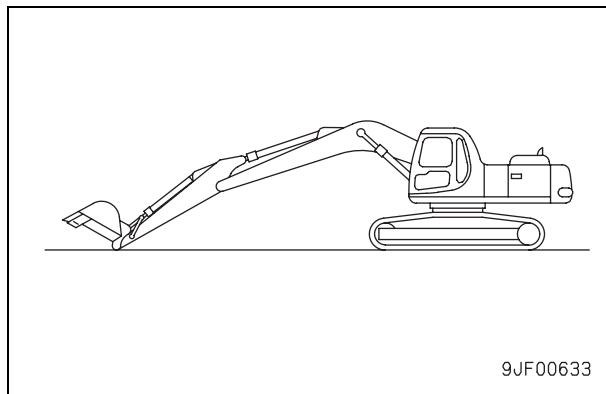


- 2) Check the oil level by sight gauge (3) of the hydraulic tank.

- ★ If the oil leakage is between lines (H) and (L), it is normal.
- ★ If the oil level is below line (L), add new oil.

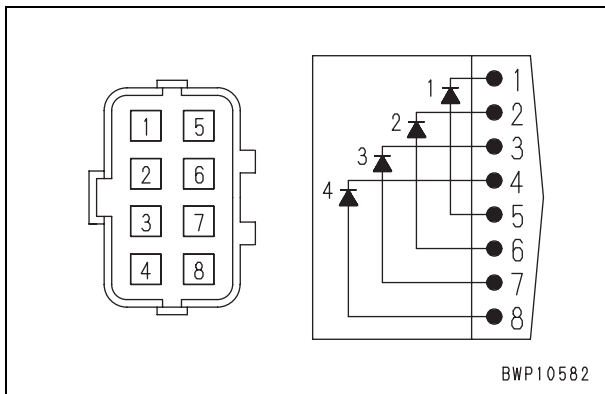
**6. Checking oil level and starting work**

- 1) Run the engine, retract the arm cylinder and bucket cylinder to the stroke ends, lower the work equipment to the ground, and stop the engine.

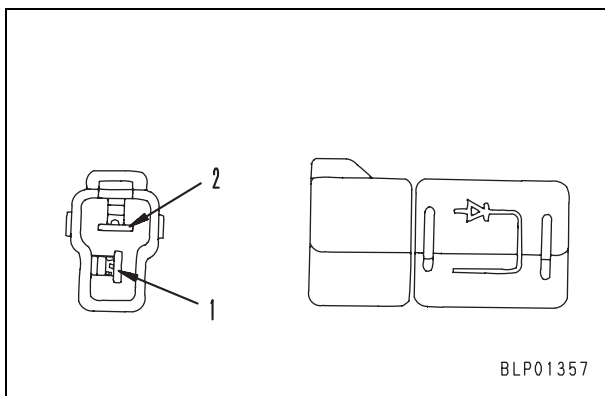


Inspection procedures for diode

- ★ Check an assembled-type diode (8 pins) and single diode (2 pins) in the following manner.



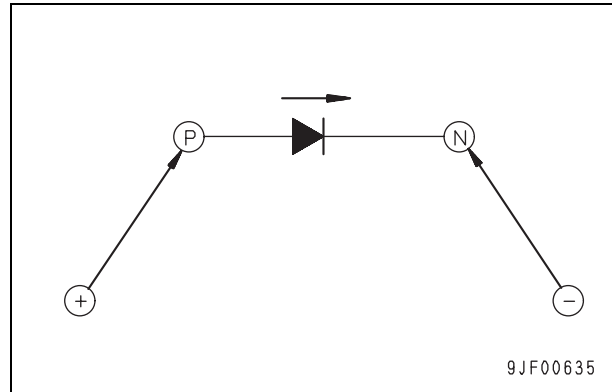
- ★ The conductive direction of each diode is marked on its surface as shown below.



1. When using digital type circuit tester

- 1) Switch the testing mode to diode range and confirm the indicated value.
 - ★ Voltage of the battery inside is displayed with conventional circuit testers.
- 2) Put the red probe (+) of the test lead to the anode (P) and the black probe (–) to the cathode (N) of diode, and confirm the displayed value.
- 3) Determine if a specific diode is good or no good with the indicated value.
 - No change in the indicated value: No continuity (defective).
 - Change in the indicated value: Continuity established (normal) (Note)

Note: A silicon diode shows a value between 460 and 600 mV.

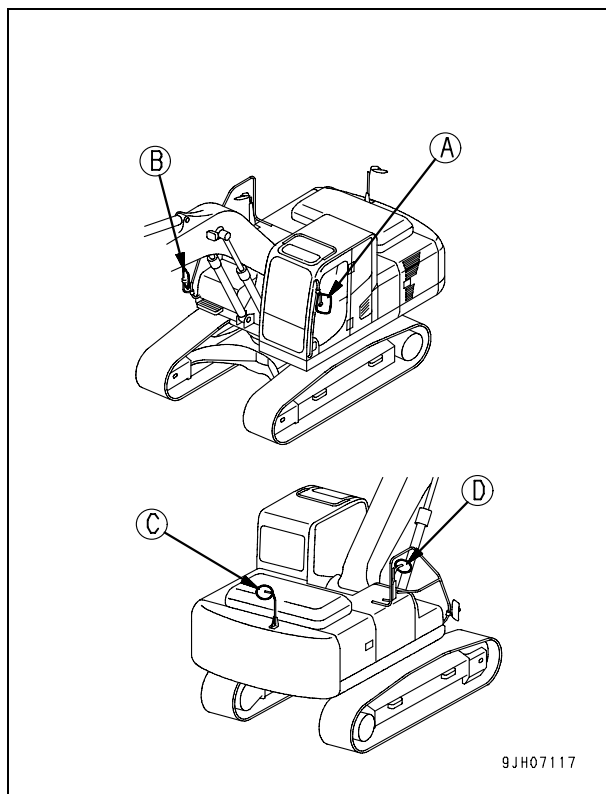


2. When using analog type circuit tester

- 1) Switch the testing mode to resistance range.
- 2) Check the needle swing in case of the following connections.
 - 1] Put the red probe (+) of the test lead to the anode (P) and the black probe (–) to the cathode (N) of diode.
 - 2] Put the red probe (+) of the test lead to the cathode (N) and the black probe (–) to the anode (P) of diode.
- 3) Determine if a specific diode is good or no good by the way the needle swings.
 - If the needle does not swing in case 1], but swings in case 2]: Normal (but the breadth of swing (i.e. resistance value) will differ depending on a circuit tester type or a selected measurement range)
 - If the needle swings in either case of 1] and 2]: Defective (short-circuited internally)
 - If the needle does not swing in any case of 1] and 2]: Defective (short-circuited internally)

Adjusting mirrors

1. Mirrors installed positions



2. Adjusting mirror (A)

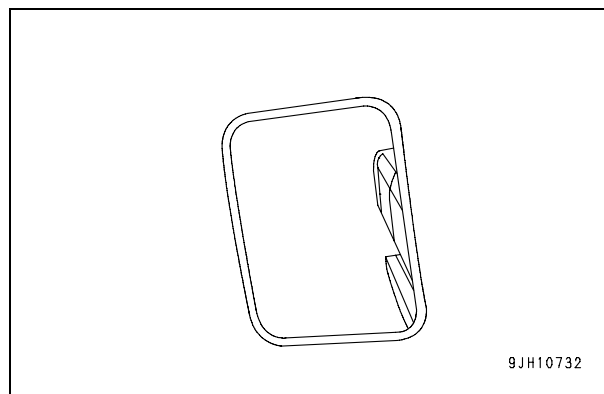
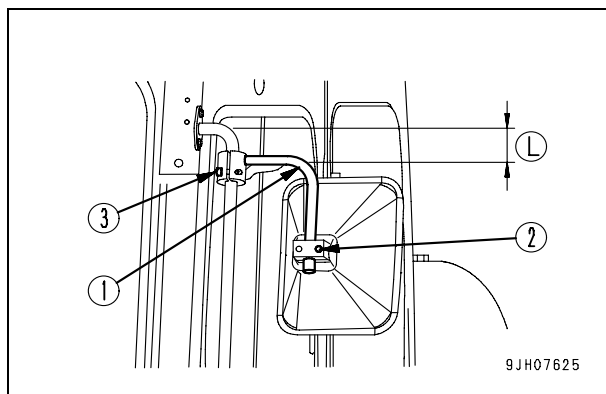
Adjust mirror (A) so that the operator can see a person who is at the left rear end of the machine.

- ★ For installation of the mirror, see the dimensions in the figure and the projection drawing in the mirror.
- ★ If the side view mirror does not move smoothly when adjusting its angle, loosen mirror securing bolt (2) and mirror securing stay bolt (3).

⌘ Bolt (2):

4.0 – 5.4 Nm {0.41 – 0.55 kgm}

- Fix mirror securing stay (1) the way the side view mirror stretches outward to the maximum.
- Dimension (L): 120 mm



3. Adjusting mirror (B)

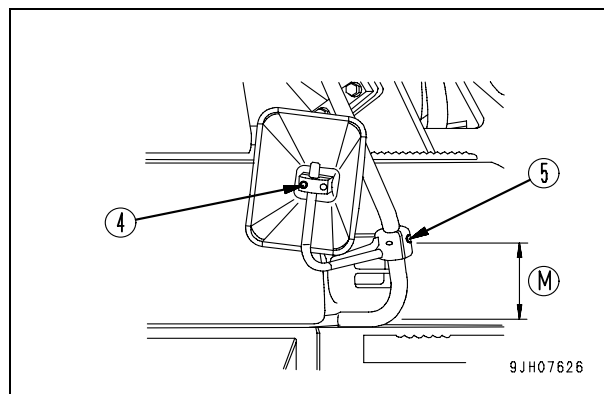
Adjust mirror (B) so that the operator can see a person who is at the rear end of the machine.

- ★ For installation of the mirror, see the dimensions in the figure and the projection drawing in the mirror.
- ★ If the side view mirror does not move smoothly when adjusting its angle, loosen mirror securing bolt (4) and mirror securing stay bolt (5).

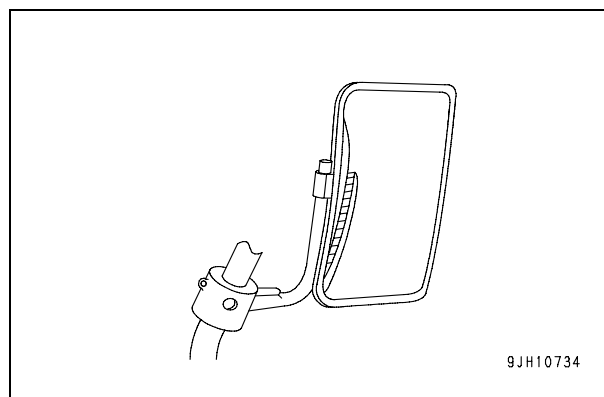
⌘ Bolt (4):

4.0 – 5.4 Nm {0.41 – 0.55 kgm}

- Dimension (M): 100 mm



- When adjusting the side view mirror angle, make an adjustment so that the side of the machine comes into view on the mirror.



4. Adjusting mirror (C/D)

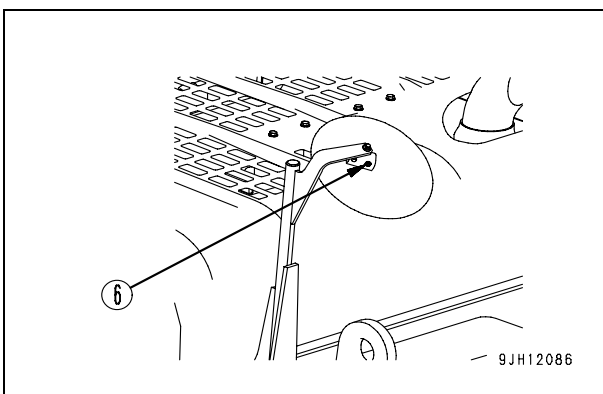
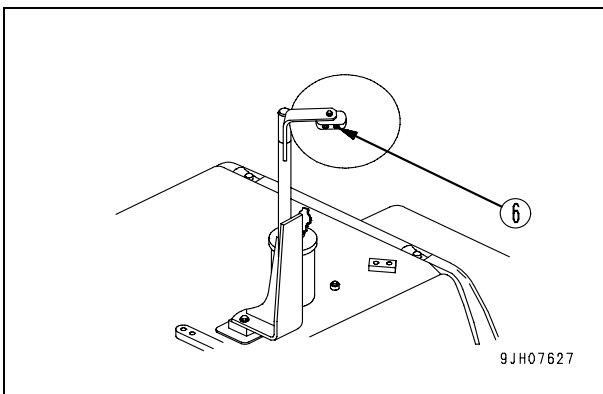
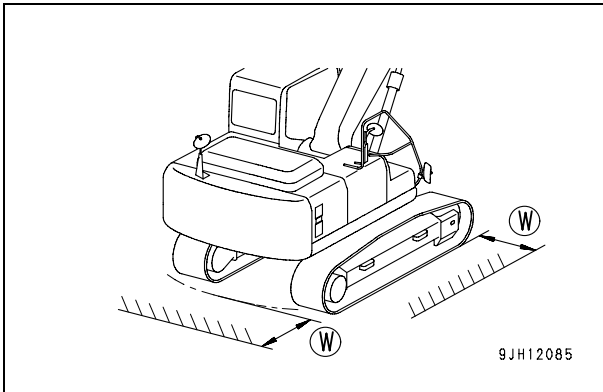
Adjust mirror (C/D) so that the operator can see a person who is on the ground 1m around the machine (hatched part) from the operator's seat.

- ★ If side view mirror (C), (D) does not move smoothly when adjusting its angle, loosen mirror securing screw (6).

🔧 Screw (6):

0.98 – 1.47 Nm {0.10 – 0.15 kgm}

- Dimension (W): 1,000 mm



PC160LC-7E0, PC180LC/NLC-7E0 Hydraulic excavator

Form No. UEN02109-01

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HYDRAULIC EXCAVATOR

PC160LC-7E0

PC180LC-7E0

PC180NLC-7E0

Machine model Serial number

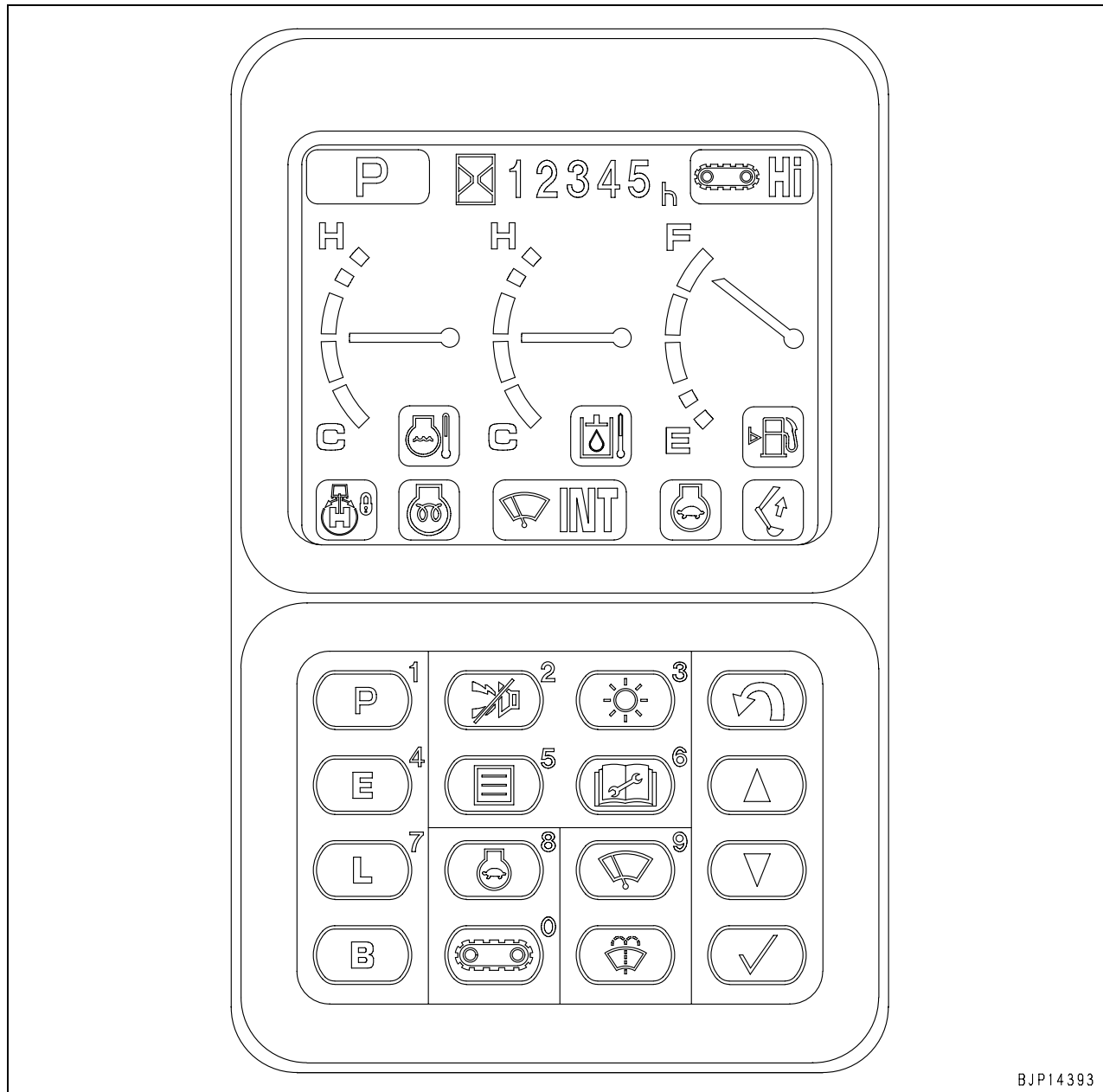
PC160LC-7E0	K45001 and up
PC180LC-7E0	K45001 and up
PC180NLC-7E0	K45001 and up

30 Testing and adjusting

Testing and adjusting, Part 3

Special functions of machine monitor	2
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Preparation work for troubleshooting of electrical system	37
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Special functions of machine monitor



- [1]: Figure input switch 1
- [2]: Figure input switch 2
- [3]: Figure input switch 3
- [4]: Figure input switch 4
- [5]: Figure input switch 5
- [6]: Figure input switch 6
- [7]: Figure input switch 7
- [8]: Figure input switch 8
- [9]: Figure input switch 9
- [0]: Figure input switch 0

- [↶]: Return switch
- [△]: Upward move switch
- [▽]: Downward move switch
- [✓]: Input confirmation switch

Ordinary functions and special functions of machine monitor

The machine monitor has the ordinary function and special functions and displays information of various types on the multi-display.

Some items are displayed automatically and others are displayed through the switch operations according to the internal setting of the machine monitor.

- **Ordinary functions: Operator menu**

The functions in this mode are displayed ordinarily. Display and setting of these functions are available from the operator's switch operations.

- **Special functions: Service menu**

The functions in this mode are not ordinarily displayed. Display and setting of these functions are available from the serviceman's operations of the special switches.

This mode is used for special setting, testing, adjusting or troubleshooting.

Operator menu	
1	Password input and setting function
2	KOMATSU logo display screen
3	Check before starting function
4	Maintenance display function
5	Caution items display function
6	Check of working mode and travel speed function
7	Ordinary screen display function
8	Display's brightness and contrast adjustment function
9	E-mode adjustment and pump flow rate adjustment function when breaker or attachment is used
10	Check of maintenance information function
11	Service meter display function
12	Check of display LCD function
13	Caution generation display function
14	User code display function
15	Failure code display function

Service menu		
16	Function of monitoring [01]	
17	Function of abnormality record [02]	Electrical systems
		Mechanical systems
18	Function of maintenance record [03]	
19	Function of maintenance mode change [04]	
20	Function of phone number entry [05]	
21	Function of default [06]	Mode with key ON
		Language
		Unit
		With/Without attachment
22	Function of adjustment [07]	Pump absorption torque
		Adjustment of flow to attachment in compound operation
23	Function of cylinder cut-out operation [08]	
24	Function of no injection cranking [09]	

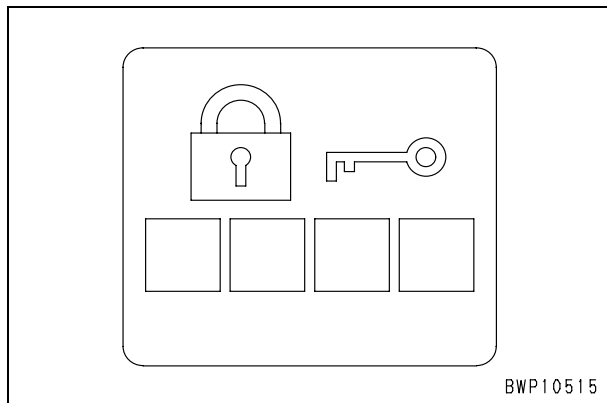
Operation of operator menu and display (outline)

- ★ This section introduces only the outline of the operator menu. For details on the contents and operation steps of each menu, refer to the “Operation and maintenance manual” or the chapter of “Structure, function and maintenance standard” in this shop manual.

1. Password input and setting function

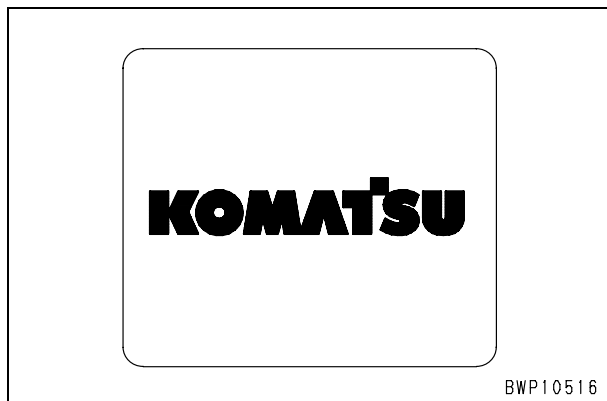
Displays the password input screen as the starting switch is turned ON.

- ★ Above display is available only when the password function is selected.



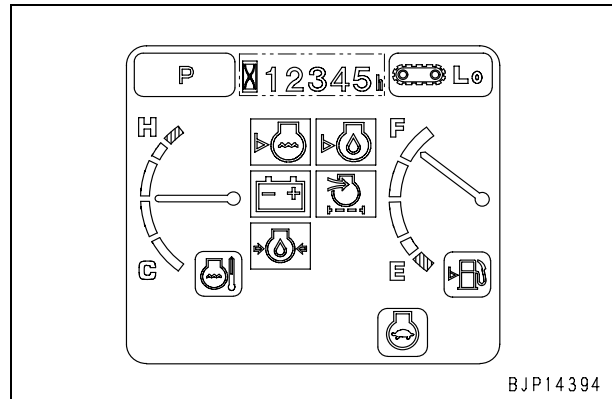
2. KOMATSU logo display screen

KOMATSU logo is displayed for 2 seconds as a password is entered (as a password is specified) or the starting switch is turned ON.



3. Check before starting function

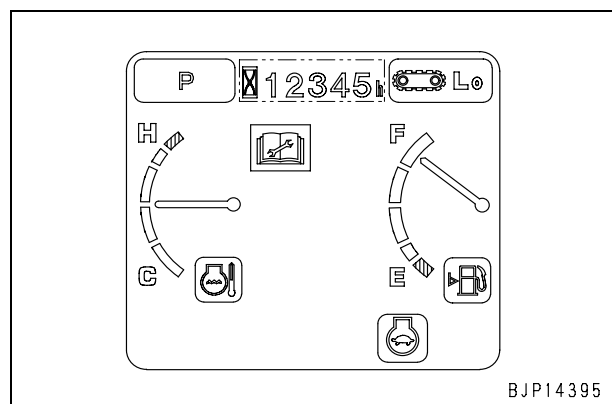
Check before starting screen is displayed for 2 seconds succeeding to display of KOMATSU logo.



4. Maintenance display function

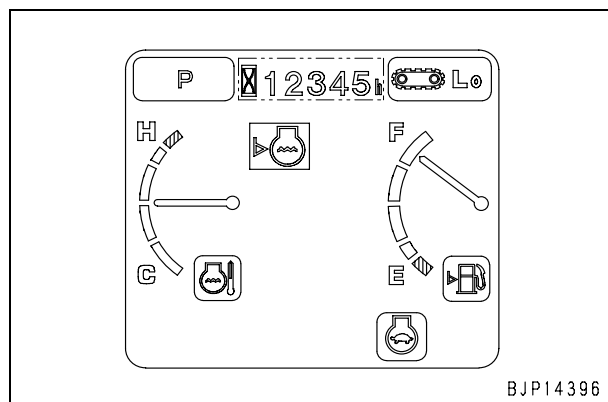
Succeeding to display of the check before starting screen, a maintenance mark appears for 30 seconds pointing the oil or filter whose specified maintenance time has already expired or is going to expire soon.

- ★ Below display is available only when the maintenance function is selected.



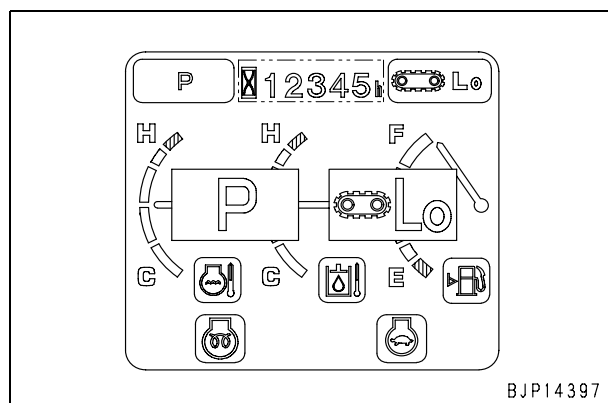
5. Caution items display function

Succeeding display of the check before starting screen, an applicable caution mark appears pointing a check before starting item on which a problem was found.



6. Check of working mode and travel speed function

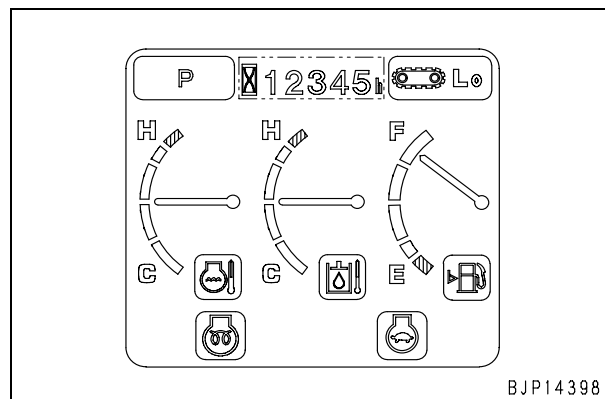
Succeeding to display of the check before starting screen, symbol marks of the working mode and travel speed appear sizably on the screen to alert the operator attention to the setting.



7. Ordinary screen display function

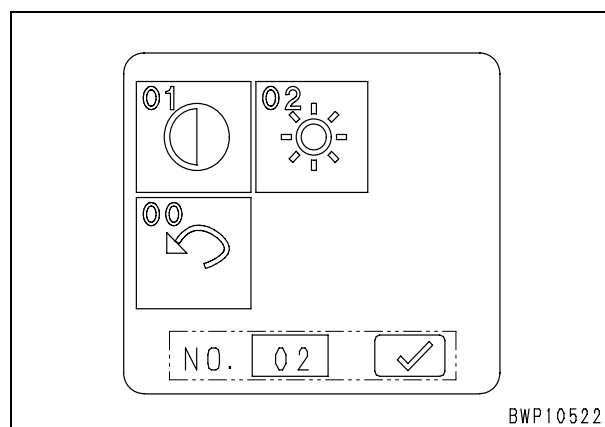
The ordinary display is turned on succeeding to display of the check of working mode and travel speed screen.

- ★ If the currently set working mode or travel speed is changed or if setting of the auto-deceleration or wiper is enabled from the ordinary screen, an applicable symbol mark is displayed large for 2 seconds.
- ★ The engine pre-heating monitor is displayed only when the pre-heating operation is turned on.



8. Display's brightness and contrast adjusting function

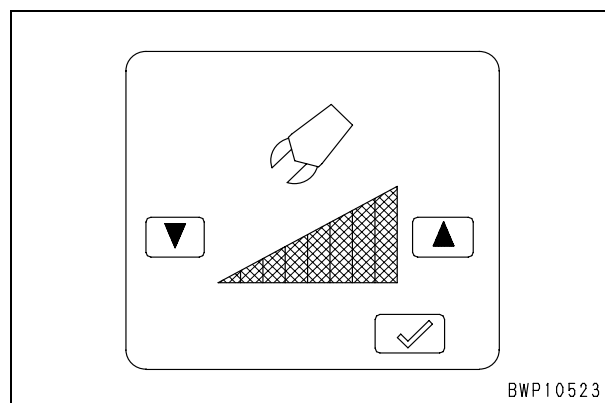
The screen adjustment switches allow adjusting the display brightness and contrast.



9. E-mode adjustment, flow rate adjustment function when breaker or attachment is used (for a machine equipped with breaker and attachment)

The select switch allows adjusting E-mode and also adjusting the pump flow rate when the breaker or attachment is used.

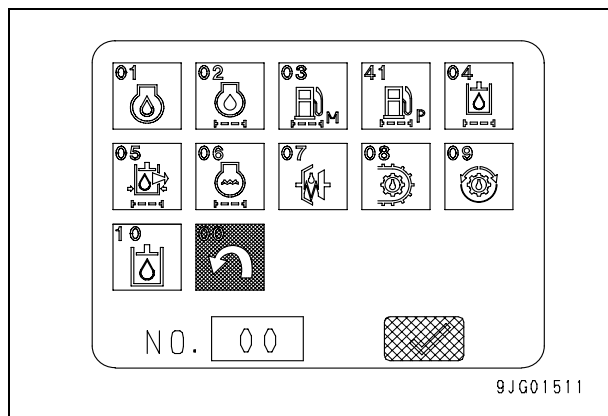
- ★ There are some differences between the symbol mark of the breaker and attachment displayed on the screen as well as in the messages displayed.



10. Check of maintenance information function

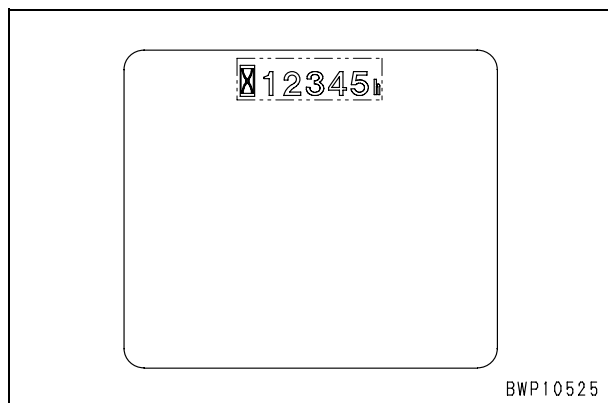
The maintenance switch allows checking detailed information of the maintenance items (specified maintenance time and elapsed time). It also allows resetting after the maintenance.

- ★ Setting and resetting of the maintenance function as well as setting of the maintenance time is done from the service menu.

**11. Service meter display function**

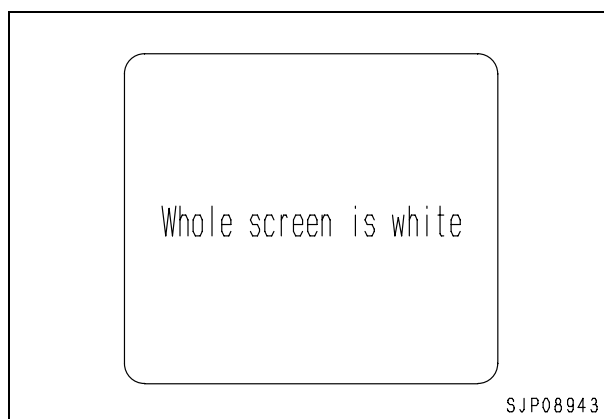
Display of the service meter alone becomes available by operating the following switches after the starting switch is turned OFF.

- Switch operation: [↵] + [△]
(Simultaneous operation)

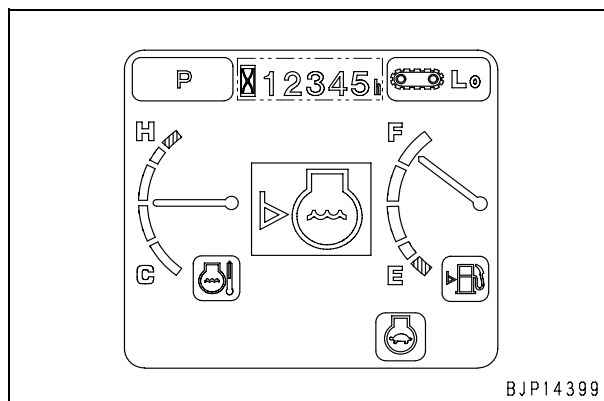
**12. Check of display LCD function**

Display of the display LCD can be checked by operating the following switches from the password input screen or ordinary screen.

- Switch operation: [↵] + [P]
(Simultaneous operation)
- ★ The entire LCD should come on, turning the screen to white. The display is, therefore, acceptable if it is free from any black spot.
- ★ Operating any switch from the checkup display restores the immediately preceding screen.

**13. Caution generation display function**

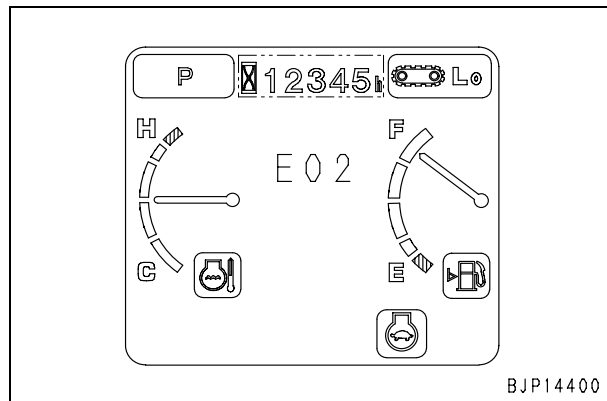
If a caution is warned for a caution item, applicable symbol mark is displayed large for 2 seconds and then it remains on the screen in a smaller size until the trouble is eliminated.



14. User code display function

If a trouble occurs on the machine, an applicable user code is automatically displayed depending on the seriousness of the trouble in order to alert the operator to take an appropriate action.

- ★ Operating any switch while a user code is on the screen, switches the failure code display screen (see Item 15).



★ User codes and actions requested to operator

User code	Failure mode	Action
E02	Pump control system error	When emergency pump drive switch is at the up (emergency) position, normal operations become possible, but have inspection carried out immediately.
E03	Swing brake system error	Move the swing brake cancel switch up to release the brake. When applying the swing brake, operate the swing lock switch manually. Depending on the cause of the problem, it may not be possible to release it. In any case, have inspection carried out immediately.
E10	Engine controller power source error Engine controller drive system circuit error (engine stopped)	Have inspection carried out immediately.
E11	Engine controller system error (Output reduced to protect engine)	Operate machine to a safe posture and have inspection carried out immediately.
E14	Throttle system error	Operate machine to a safe posture and have inspection carried out immediately.
E15	Engine sensor (coolant temperature, fuel temperature and oil pressure) system error	Operations are possible, but have inspection carried out immediately.
E0E	Network error	Operate machine to a safe posture and have inspection carried out immediately.

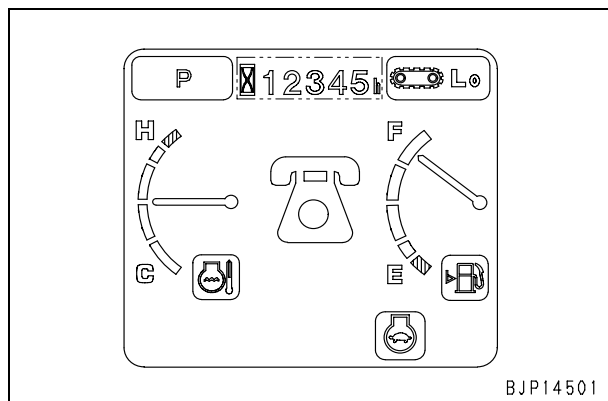
15. Failure code display function

Operating any switch while a user code is on the screen, sequentially displays the phone mark (if registered), phone number (if registered) and failure code.

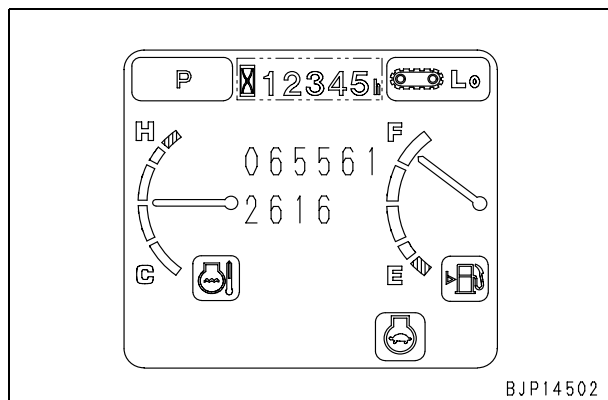
- Switching operation: (✓) (keep the switch depressed)
- ★ The screen display sequentially changes as shown below as long as the switch is being depressed.

- ★ The telephone mark and telephone number are displayed only when the telephone number is registered to the machine monitor.
Registration, correction or deletion of a telephone number is done from the service menu.
- ★ For detailed information of failure codes, see the failure codes table.

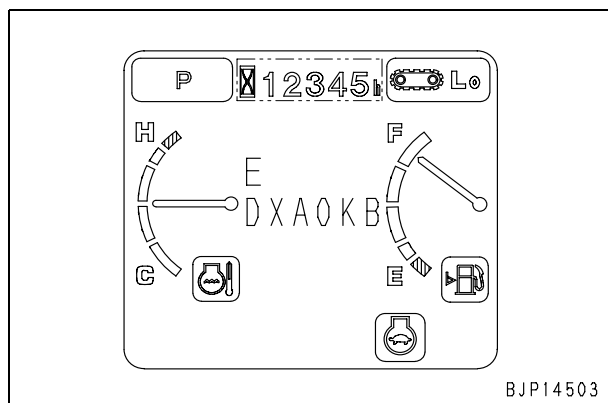
(1) Telephone symbol mark



(2) Telephone number



(3) Failure code



Failure codes table

User code	Failure code	Trouble (Displayed on screen)	Device in charge	Category of record
—	AA10NX	Air cleaner clogging	MON	Mechanical system
—	AB00KE	Charge voltage low	MON	Mechanical system
—	B@BAZG	Eng. oil press. low	MON	Mechanical system
—	B@BAZK	Eng oil level low	MON	Mechanical system
—	B@BCNS	Eng coolant overheat	MON	Mechanical system
—	B@BCZK	Eng coolant level low	MON	Mechanical system
—	B@HANS	Hydr oil overheat	MON	Mechanical system
E10	CA111	EMC critical internal failure	ENG	Electrical system
E10	CA115	Eng Ne and bkup speed sens error	ENG	Electrical system
E11	CA122	Chg air press sensor high error	ENG	Electrical system
E11	CA123	Chg air press sensor low error	ENG	Electrical system
E14	CA131	Throttle sensor high error	ENG	Electrical system
E14	CA132	Throttle sensor low error	ENG	Electrical system
E15	CA144	Coolant temp sens high error	ENG	Electrical system
E15	CA145	Coolant temp sens low error	ENG	Electrical system
E15	CA153	Chg air temp sensor high error	ENG	Electrical system
E15	CA154	Chg air temp sensor low error	ENG	Electrical system
E11	CA155	Chg air temp high speed delete	ENG	Electrical system
E15	CA187	Sens supply 2 volt low error	ENG	Electrical system
E11	CA221	Ambient press sens high error	ENG	Electrical system
E11	CA222	Ambient press sens low error	ENG	Electrical system
E15	CA227	Sens supply 2 volt high error	ENG	Electrical system

User code	Failure code	Trouble (Displayed on screen)	Device in charge	Category of record
—	CA234	Eng overspeed	ENG	Mechanical system
E15	CA238	Ne speed sens supply volt error	ENG	Electrical system
E10	CA271	IMV/PCV1 short error	ENG	Electrical system
E10	CA272	IMV/PCV1 open error	ENG	Electrical system
E11	CA322	Inj #1 (L#1) open/short error	ENG	Electrical system
E11	CA324	Inj #3 (L#3) open/short error	ENG	Electrical system
E11	CA331	Inj #2 (L#2) open/short error	ENG	Electrical system
E11	CA332	Inj #4 (L#4) open/short error	ENG	Electrical system
E10	CA342	Calibration code incompatibility	ENG	Electrical system
E10	CA351	Injectors drive circuit error	ENG	Electrical system
E15	CA352	Sens supply 1 volt low error	ENG	Electrical system
E15	CA386	Sens supply 1 volt high error	ENG	Electrical system
E15	CA428	Water in fuel sensor high error	ENG	Electrical system
E15	CA429	Water in fuel sensor low error	ENG	Electrical system
E15	CA435	Engine oil pressure error	ENG	Electrical system
E10	CA441	Engine controller battery voltage low error	ENG	Electrical system
E10	CA442	Engine controller battery voltage high error	ENG	Electrical system
E11	CA449	Rail press very high error	ENG	Electrical system
E11	CA451	Rail press sensor high error	ENG	Electrical system
E11	CA452	Rail press sensor low error	ENG	Electrical system
E11	CA488	Chg air temp high torque derate	ENG	Electrical system
E15	CA553	Rail press high error	ENG	Electrical system
E15	CA559	Rail press low error	ENG	Electrical system
E15	CA689	Eng Ne speed sensor error	ENG	Electrical system
E15	CA731	Eng bkup speed sens phase error	ENG	Electrical system

User code	Failure code	Trouble (Displayed on screen)	Device in charge	Category of record
E10	CA757	All continuous data lost error	ENG	Electrical system
E15	CA778	Eng bkup speed sensor error	ENG	Electrical system
E0E	CA1633	KOMNET datalink timeout error	ENG	Electrical system
E14	CA2185	Throt sens sup volt high error	ENG	Electrical system
E14	CA2186	Throt sens sup volt low error	ENG	Electrical system
E11	CA2249	Rail press very low error	ENG	Electrical system
E11	CA2311	IMV solenoid error	ENG	Electrical system
E15	CA2555	Grid htr relay volt high error	ENG	Electrical system
E15	CA2556	Grid htr relay volt low error	ENG	Electrical system
—	D110KB	Battery relay output	PUMP	Electrical system
—	D196KA	Service return relay disc.	PUMP	Electrical system
—	D196KB	Service return relay S/C	PUMP	Electrical system
E0E	DA22KK	Pump solenoid power low error	PUMP	Electrical system
E02	DA25KP	Press. sensor power volt low	PUMP	Electrical system
E0E	DA2RMC	Comm. error (Pump controller)	PUMP	Electrical system
—	DA2SKQ	Model selection signal for model code input mismatch	PUMP	Electrical system
E0E	DAFRMC	Comm. error (Machine monitor)	PUMP	Electrical system
—	DGH2KB	Hydr oil sensor short	MON	Electrical system
—	DHPAMA	F pump press sensor abnormality	PUMP	Electrical system
—	DHPBMA	R pump press sensor abnormality	PUMP	Electrical system
—	DHSAMA	Swing RH PPC press sensor abnormality	PUMP	Electrical system
—	DHSBMA	Swing LH PPC press sensor abnormality	PUMP	Electrical system
—	DW43KA	Travel speed sol. disc.	PUMP	Electrical system
—	DW43KB	Travel speed sol. S/C	PUMP	Electrical system
E03	DW45KA	Swing brake sol. disc.	PUMP	Electrical system
E03	DW45KB	Swing brake sol. S/C	PUMP	Electrical system

User code	Failure code	Trouble (Displayed on screen)	Device in charge	Category of record
—	DW91KA	Travel junction sol. disc.	PUMP	Electrical system
—	DW91KB	Travel junction sol. S/C	PUMP	Electrical system
—	DWJ0KA	Merge-divider sol. disc.	PUMP	Electrical system
—	DWJ0KB	Merge-divider sol. s/c	PUMP	Electrical system
—	DWK0KA	2-stage relief sol. disc.	PUMP	Electrical system
—	DWK0KB	2-stage relief sol. S/C	PUMP	Electrical system
E02	DXA0KA	PC-EPC sol. disc.	PUMP	Electrical system
E02	DXA0KB	PC-EPC sol. S/C	PUMP	Electrical system
—	DXE4KA	Service current EPC disc.	PUMP	Electrical system
—	DXE4KB	Service current EPC S/C	PUMP	Electrical system
—	DY20KA	Wiper working abnormality	PUMP	Electrical system
—	DY20MA	Wiper parking abnormality	PUMP	Electrical system
—	DY2CKB	Washer drive S/C	PUMP	Electrical system
—	DY2DKB	Wiper drive (for) S/C	PUMP	Electrical system
—	DY2EKB	Wiper drive (rev) S/C	PUMP	Electrical system

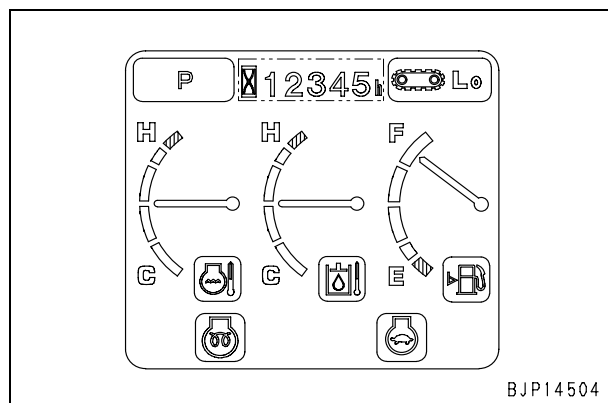
- ★ This table lists the failed sections in the order of the failure code.
- ★ Those failure codes to which the corresponding number is not indicated in the user code space are not displayed on the ordinary screen if a failure is found. They are just recorded in the failure record (electrical system and mechanical system) of the service menu.
- ★ The category of record is used for indicating to which of the electrical and mechanical system of the service menu's abnormality record a given failure is classified.
- ★ **E** at beginning of the user code indicates the following state.
 - With **E**: The failure still remains without being resolved.
 - Without **E**: The failure is already resolved.

Service menu operation and display

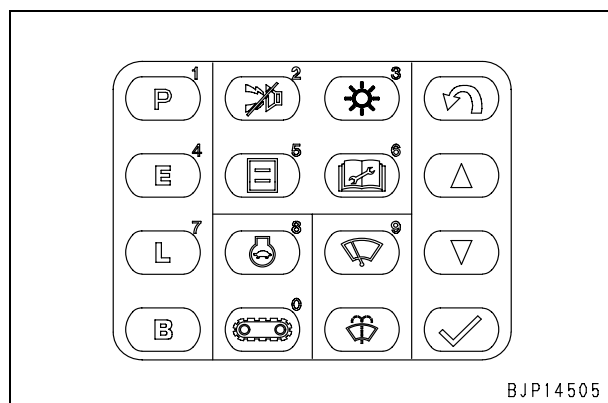
Switching to Service Menu

- ★ When using the service menu, switch the screen through the following special operation.

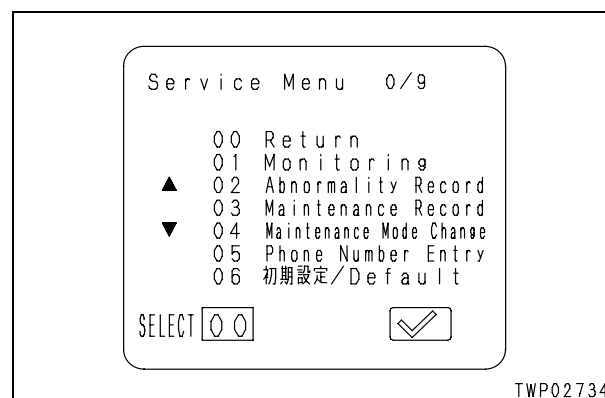
- 1) Confirmation of display
Make sure that the conventional display is turned on.
 ★ Changing to Service Menu is usually available only from this conventional display.



- 2) Switch operation
Do the following switch operation.
 - Switch operation: [△] + [1] → [2] → [3]
(Enter the numbers while holding △ down)



- 3) Displaying menu screen
The display is changed to the initial display of Service Menu program. Select an appropriate item from among the menu.



No.	Service menu
00	Return (Ends the service menu)
01	Monitoring
02	Abnormality record
03	Maintenance record
04	Maintenance mode change
05	Phone number entry
06	Default
07	Adjustment
08	Cylinder cut out
09	No injection cranking

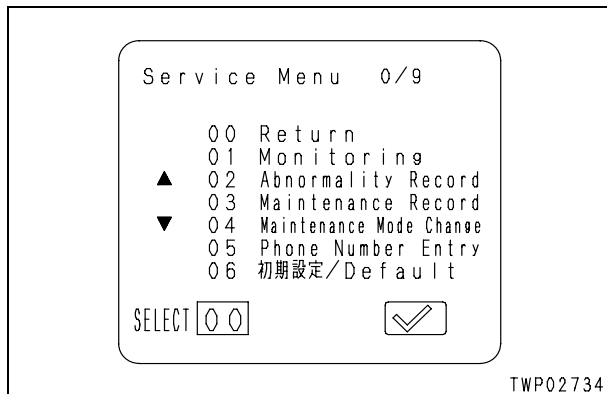
- 4) Ending the menu and function
When ending the operation from the service menu screen or respective menu screens, select either of the following operations.
 - Press [↶] switch (enables every screen).
 - When “RETURN” switch is displayed, press the applicable switch.
 - When “Return” menu is displayed, select the menu and press [✓] switch.

16. Monitoring [01] function

The machine monitor monitors signals from the switch sensor actuators on various machine parts. It allows displaying and checking the monitored information through following operations.

1) Menu selection

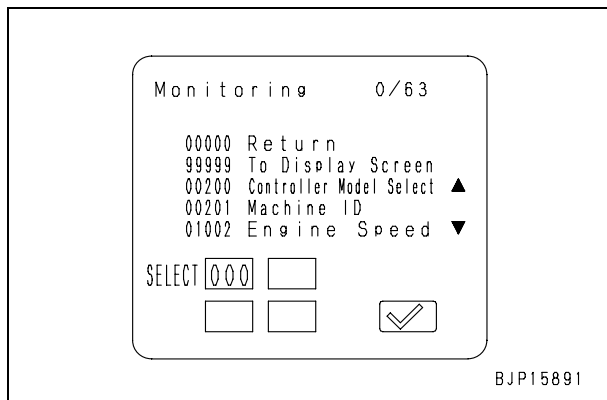
Select "01 Monitoring" in the initial display of Service Menu and depress [✓] switch.



2) Setting a monitoring item

Select and register an item to be monitored through the following switch operation.

- [△] switch: Selection
- [▽] switch: Selection
- [✓] switch: Registration



- ★ A monitoring item can be set from 1 to 4 at maximum (Depending upon the selected item, the max. number can be less than four)

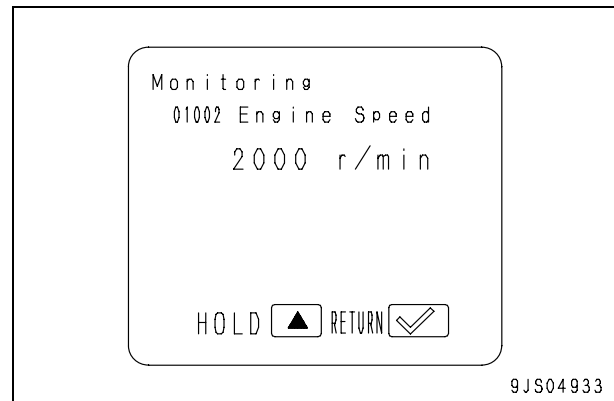
- ★ In case of monitoring 1 to 3 items, move to the monitoring information screen through any of the following switch operations after the registration work has been completed.

- [Hold down [✓] switch (for about 3 seconds).
- Select menu "99999" and press [✓] switch.

- ★ When you have registered all the items that can be registered, the screen will be automatically switched to the monitoring information screen.
- ★ Monitored information are transmitted via communication circuits. Thus the number of selected items can impact the communication speed. If truly real time monitoring is required, reduce the selected items to the minimum.
- ★ For details on the monitoring items, display unit, etc., refer to the Table for Monitoring Items.

3) Operation for monitoring

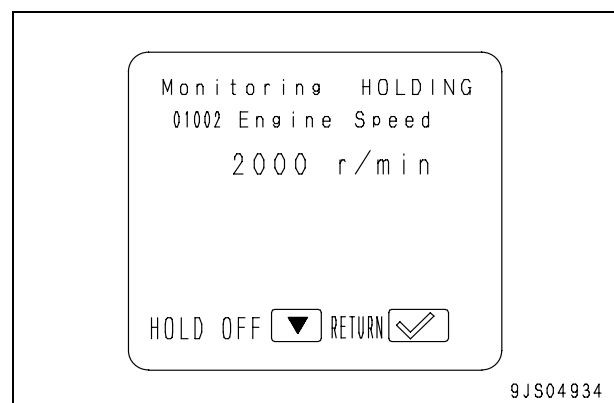
As the monitoring information screen is displayed, confirm the monitored information operating the machine.



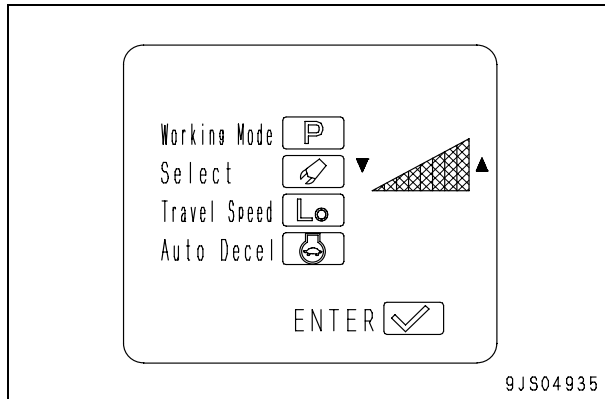
4) Monitored information holding function

You can hold every monitored information by pressing [△] while monitoring is continued.

If you press [▽] switch again in this condition, the currently held information will be released.



- 5) Machine setup mode switching function
 If it becomes necessary to change settings of working mode, select mode, travel speed and auto-decel while monitoring, depress the corresponding switch, then the mode confirmation display is shown.



- ★ Above figure shows the screen display in P-and E-mode (in B-mode, part of the symbol mark shape is different from above).
- ★ After confirming the setting, press [✓] switch to return to the monitoring screen.
- ★ If the setting was changed during monitoring, the new setting is held even after the operator menu is restored from the service menu after the monitoring is finished.

List of Monitoring Items

Code No.	Monitoring item	Unit (Default: ISO)			Remarks
		ISO	meter	inch	
00000	Return	(Not display)			End menu
99999	Display execution	(Not display)			Display execution menu
00200	Controller Model Select	Numbers			
00201	Machine ID	Numbers			
01002	Engine Speed	r/min	rpm	rpm	
09001	Swing left PPC Pressure	MPa	kg/cm ²	psi	
09002	Swing right PPC Pressure	MPa	kg/cm ²	psi	
04107	Coolant Temperature	°C	°C	°F	
04401	Hydr. Oil Temperature	°C	°C	°F	
01300	PC-EPC Sol. Curr.	mA	mA	mA	
01500	LS-EPC Sol. Curr.	mA	mA	mA	
01700	Service Sol. Curr.	mA	mA	mA	
03200	Battery Voltage	V	V	V	
03203	Battery Power Supply	V	V	V	
04300	Battery Charge Vol.	V	V	V	
01006	Engine Seed	r/min	rpm	rpm	
36400	Rail Pressure	MPa	kg/cm ²	psi	
37400	Ambient Pressure	kPa	kg/cm ²	psi	
18500	Charge Temperature	°C	°C	°F	
36500	Boost Pressure	kPa	kg/cm ²	psi	
36700	Engine Torque Ratio	%	%	%	
18700	Engine Output Torque	Nm	kgm	lbft	
03000	Fuel Dial Pos Sens Volt	V	V	V	
04200	Fuel Level Sensor Vol.	V	V	V	
04105	Eng. Water Temp. Vol. Lo	V	V	V	
04402	Hydr. Temp. Sensor Vol.	V	V	V	
37401	Ambient Press Sens Volt	V	V	V	
18501	Charge Temp Sens Volt	V	V	V	
36501	Charge Press Sens Volt	V	V	V	
36401	Rail Pressure Sens Volt	V	V	V	
17500	Engine Power Mode	—	—	—	
31701	Throttle Position	%	%	%	
31706	Final Throttle Position	%	%	%	
18600	Inject Fuelling Command	mm ³ /st	mm ³ /st	mm ³ /st	
36200	Rail Press Command	MPa	kg/cm ²	psi	
36300	Injection Timing Command	CA	CA	CA	
37300	Fuel Rate	L/h	L/h	L/h	
01602	2nd Eng. Speed Command	%	%	%	
13113	Main Pump Absorb Torque	Nm	kgm	lbft	

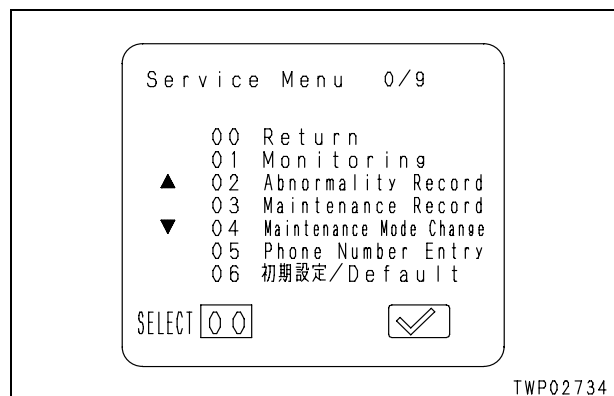
Code No.	Monitoring item		Unit (Default: ISO)			Remarks
			ISO	meter	inch	
01900	Pressure Switch 1	Swing	ON/OFF			
		Travel	ON/OFF			
		Boom Lower	ON/OFF			
		Boom Raise	ON/OFF			
		Arm In	ON/OFF			
		Arm Out	ON/OFF			
01901	Pressure Switch 2	Bucket Curl	ON/OFF			
		Bucket Dump	ON/OFF			
		Service	ON/OFF			
		Travel Steering	ON/OFF			
02300	Solenoid Valve 1	Travel Junction	ON/OFF			
		Swing Brake	ON/OFF			
		Merge-divider	ON/OFF			
		2-Stage Relief	ON/OFF			
		Travel Speed	ON/OFF			
02301	Solenoid Valve 2	Service Return	ON/OFF			
02200	Switch Input 1	Lever Sw.	ON/OFF			
		Swing Release Sw.	ON/OFF			
		Swing Brake SW.	ON/OFF			
02201	Switch Input 2	Model Select 1	ON/OFF			
		Model Select 2	ON/OFF			
		Model Select 3	ON/OFF			
		Model Select 4	ON/OFF			
		Model Select 5	ON/OFF			
		Low Viscosity Fuel Mode	ON/OFF			
02202	Switch Input 3	Key Switch (ACC)	ON/OFF			
03700	Controller Output 1	Battery Relay Output	ON/OFF			
04500	Monitor Input 1	Key Switch	ON/OFF			
		Start	ON/OFF			
		Preheat	ON/OFF			
		Light	ON/OFF			
		Rad. Level	ON/OFF			
04501	Monitor Input 2	Air cleaner	ON/OFF			
		Eng. Oil Level	ON/OFF			
		Spare Open (Full-tank sensor)	ON/OFF			
		Battery Charge	ON/OFF			
04502	Monitor Input 3	Swing Brake Sw.	ON/OFF			
		Bzzr Cancel Sw.	ON/OFF			
		Window Limit Sw.	ON/OFF			
		W Limit Sw.	ON/OFF			
		P Limit Sw.	ON/OFF			
18800	Water In Fuel		—	—	—	
20216	ECM Build Version		—	—	—	
20217	ECM CAL Data Ver		—	—	—	

Code No.	Monitoring item	Unit (Default: ISO)			Remarks
		ISO	meter	inch	
18900	ECM Internal Temp	°C	°C	°F	
20400	ECM Serial No	—	—	—	
20227	Monitor Ass'y P/N	—	—	—	
20402	Monitor Serial No	—	—	—	
20200	Monitor Prog. Version	—	—	—	
20229	Pump Con. Ass'y P/N	—	—	—	
20403	Pump Con. Serial No	—	—	—	
20230	Pump Con. Prog. P/N	—	—	—	
20212	Pump Con. Prog. Version	—	—	—	

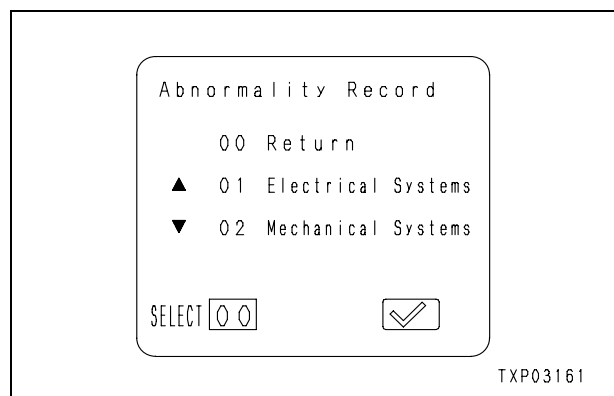
17. Function of abnormality record [02]

The monitor panel records and classifies the past failure information as into the electrical and mechanical failures. It allows displaying and checking the information through the following operations.

- 1) Menu selection
Select "02 Abnormality Record" in the initial display of Service Menu and depress [✓] switch.

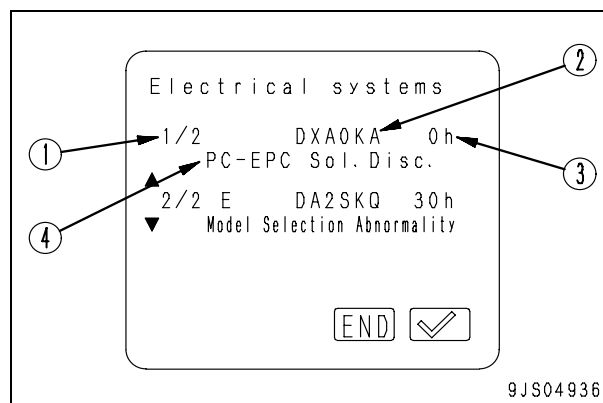


- 2) Sub menu selection
Select the sub menu from the abnormality record menu screen and then press [✓] switch.

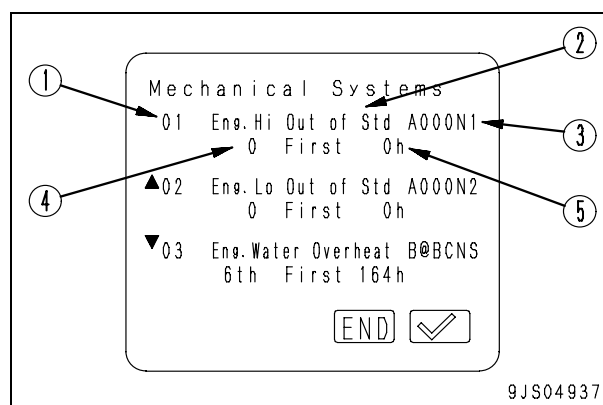


Number	Sub menu of abnormality record
00	Return (End of abnormality record)
01	Electrical systems
02	Mechanical systems

- 3) Contents of display of electrical system abnormality record information screen
 - (1): Occurrence order of abnormalities from latest one/Total number of records
 - (2): Failure code (Equipment: 4 digits, Phenomena: 2 digits)
 - (3): Elapsed time on service meter from the first occurrence
 - (4): Contents of trouble
 ★ See the operator menu "Failure codes table".

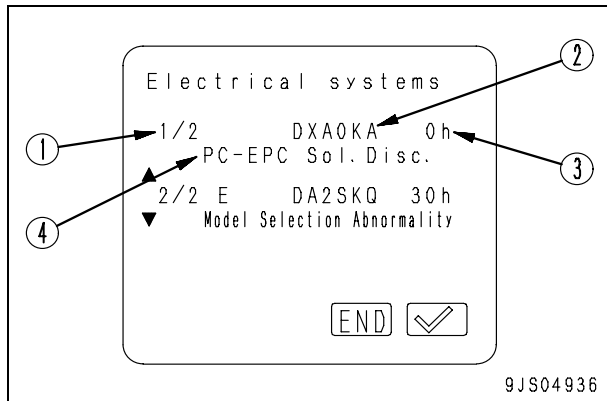


- 4) Contents of display of mechanical system abnormality record information screen
 - (1): Record number
 - (2): Contents of trouble
 - (3): Failure code (Equipment: 4 digits, Phenomena: 2 digits)
 - (4): Total number of occurrences
 - (5): Service meter reading at first occurrence
 ★ See the operator menu "Failure codes table".



5) Resetting electrical systems abnormality record

- ★ Resetting abnormality record (deletion) is possible only with the electrical system. The abnormality record in the mechanical system cannot be reset.
- ★ When resetting individual or all information in the abnormality record of the electrical systems, implement the following procedure.

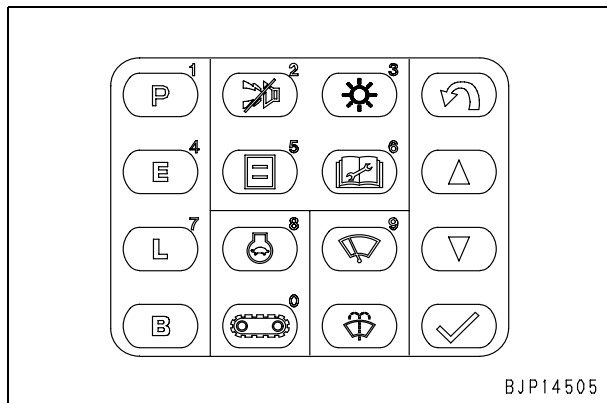


- 1] Following switch operation from the electrical system abnormality record screen opens the reset screen.

- Switch operation:

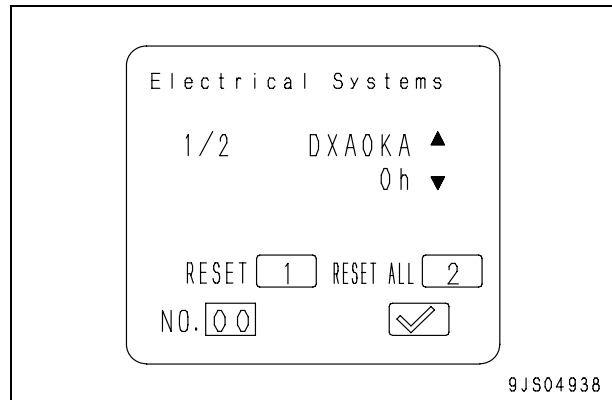
[△] + [1] → [2] → [3]

- ★ Above is the same as that done when switching to the service menu.



- 2] From the reset screen, do the switch operation according to the screen instructions.

- ★ When a specific individual information alone is to be reset, be sure to display the subject information on the screen using [△] switch or [▽] switch.
- ★ When resetting all information, the information to be displayed on the screen can be any.

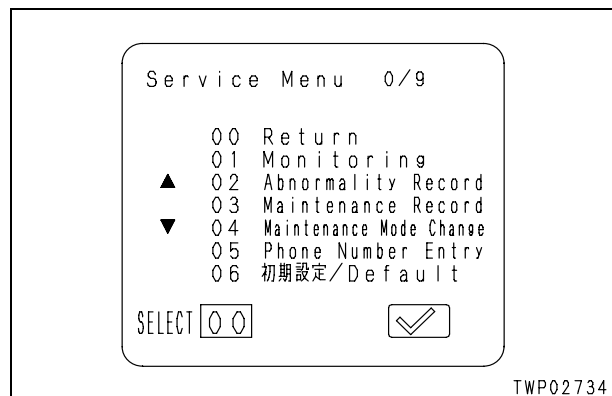


18. Function of maintenance record [03]

The machine monitor records the maintenance information of the filters, oils, etc., which the operator can display and check by the following operations.

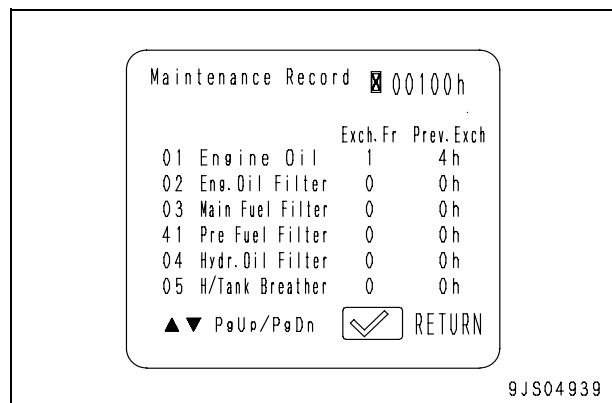
1) Menu selection

Select "03 Maintenance Record" from the initial display of Service Menu and then depress [✓] switch.



2) Information to be displayed

- Oil and filter names
- Replacement time elapsed up to present
- Time elapsed on service meter up to the last replacement



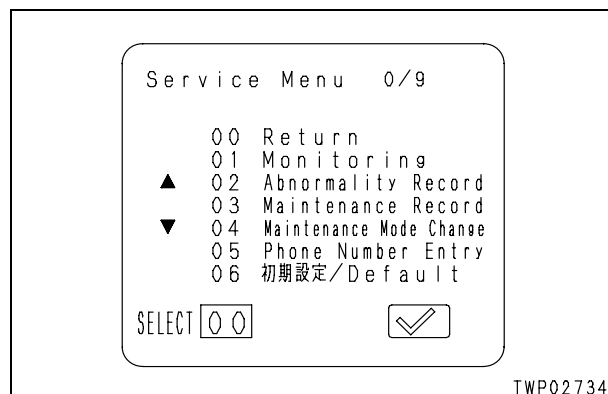
19. Function of maintenance mode change [04]

Following procedure allows changing the currently set operating conditions of the maintenance display function.

- Set function effective or ineffective
- Change set replacement interval

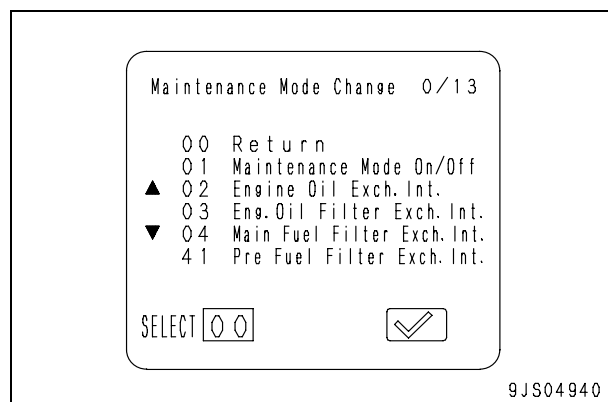
1) Menu selection

Select "04 Maintenance Mode Change" from the "Service Menu" and then depress [✓] switch.



2) Selection of item to be changed

Select the item to be changed from the "Maintenance Mode Change Selection Menu" screen.

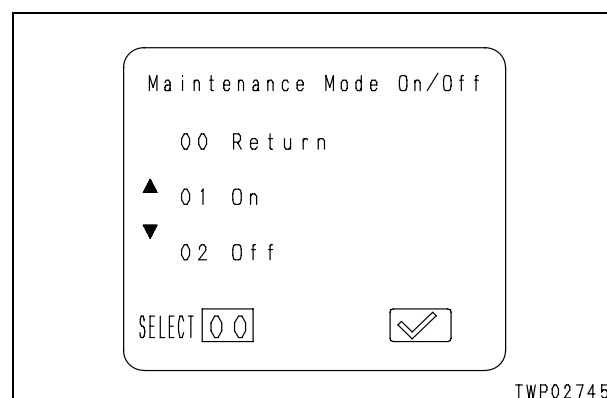


Num ber	Items of the maintenance mode change
00	Return (End of change in the maintenance mode)
01	Maintenance mode on/off
02	Engine oil change int.
03	Engine oil filter change int.
04	Fuel main filter change int.
05	Fuel pre filter change int.
06	Hyd oil filter change int.
07	Hyd tank breather change int.
08	Corrosion resistor change int.
09	Damper case service int.
10	Final drive case oil change int.
11	Machinery case oil change int.
12	Hydraulic oil change int.
13	Initialize all items

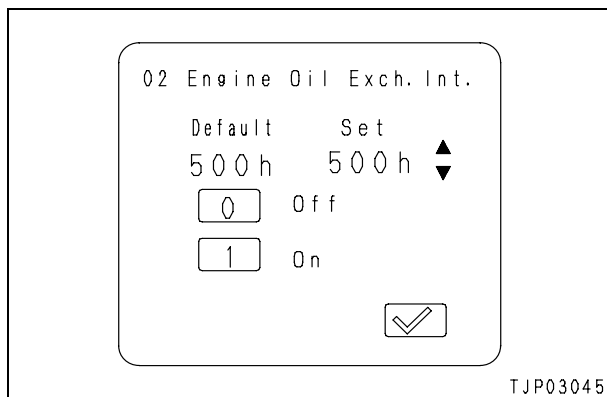
- ★ 01 and 13 menus are provided for setting the whole maintenance mode, while those from 02 through 12 are for setting individual items.

3) Contents of "Maintenance Mode On/Off"

- Use (On): The maintenance display function of all oil and filter-related items are turned effectual. (Irrespective of whether "On" or "Off" set for individual items, this setting prevails)
- Not use (Off): The maintenance display function of all oils and filter-related items is disabled (precedence is given to this setting over the "On" or "Off" selected for an individual items).



- 4) Description of individual setting items
- (1): Default value: The maintenance time set in the monitor (recommended by the manufacturer and cannot be changed).
- (2): Set value: Denotes the maintenance time that can be freely set. The maintenance mode operates based on this time (the time can be increased or decreased in multiple of 50 hours by use of [△] and [▽] switches).
- (3): Use (On): Maintenance display function for this item is enabled.
- (4): Not use (Off): Maintenance display function for this item is disabled.
- ★ The lower limit of this setting is 50 hours.



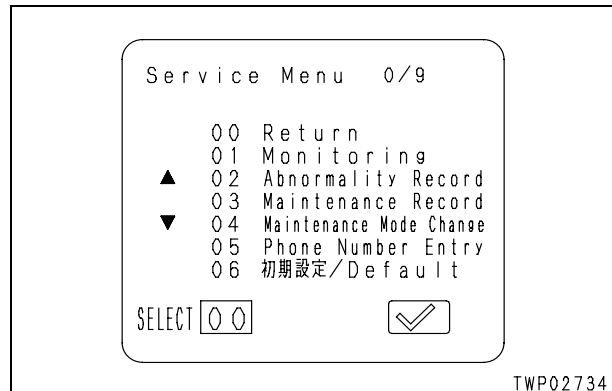
- 5) Description of "Initialize all items"
- Select this menu and then press [✓] switch to restore the default value for the individually set information.

20. Function of phone number entry [05]

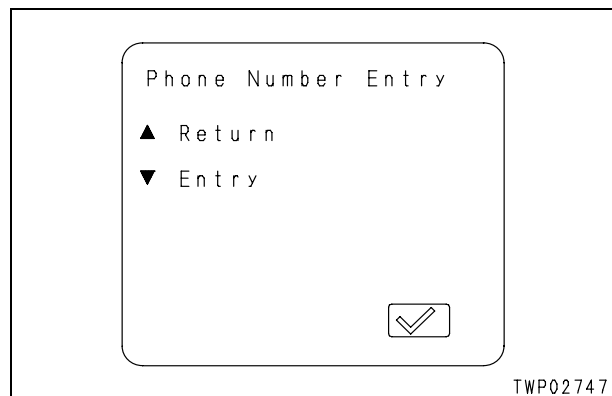
When the user code is displayed, following procedure allows entering or correcting the phone numbers to be displayed alternately with the failure code.

- ★ If a telephone number is not input, the phone number screen is not displayed.

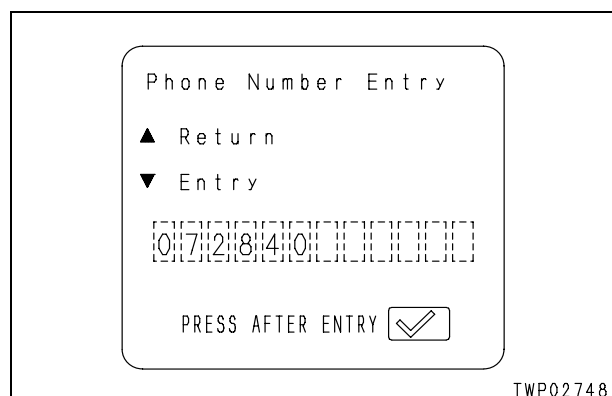
- 1) Menu selection
- Select "05 Phone Number Entry" menu from the Service Menu initial screen and then depress [✓] switch.



- 2) Changing the display
- Select "Entry" next to change the display to the "Phone Number Entry" display.
- ★ Even if a Phone number is already inputted, it is deleted if you switch the "Phone Number Entry" screen.



- 3) Entry and setting phone number
- Following the method explained below, entry a phone number in the "Phone Number Entry" display. (Entry automatically begins with a cursor at the left end)



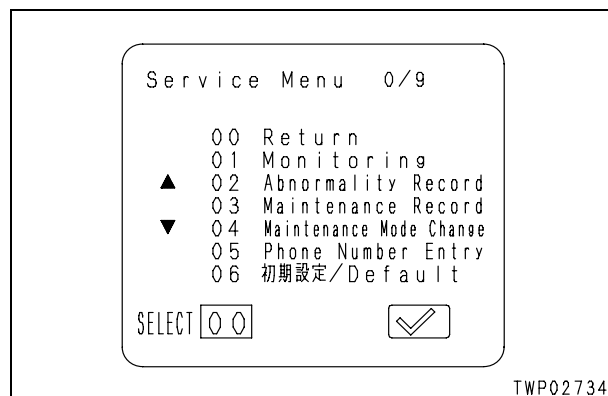
- 1) Using the numerical keypad, enter the number starting with the cursor position situated at the left end.
 - ★ Numbers can be entered up to the max. 12 digits, but omit unnecessary digits.
 - ★ When entered a wrong number, depress [B] switch to return the cursor by one digit.
- 2) Depress [✓] switch when all the numbers have been entered.
 - ★ Upon completing entry, the screen changes to the telephone No. entry screen. If the telephone number is displayed on this screen the entry is normal.

21. Function of default [06]

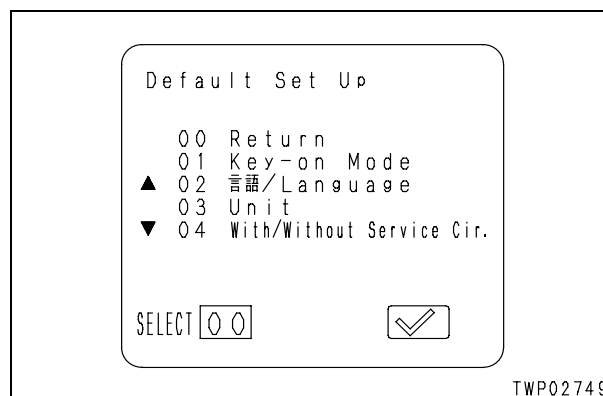
Following machine monitor- or machine-related settings are modifiable. Do necessary modifications as needed.

- Working mode as starting switch is turned ON
- Language used in the service menu
- Unit to be displayed in relation to the monitoring function
- With/Without attachment

- 1) Menu selection
Select "06 Default" menu from the Service Menu initial screen and then press [✓] switch.

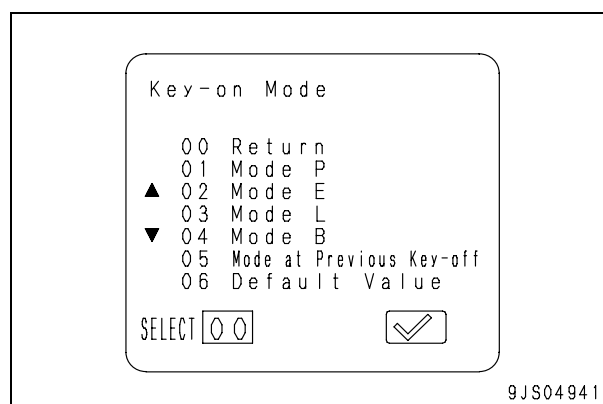


- 2) Selecting sub menu
Select the target sub menu of setting change and then press [✓] switch.



Num ber	Sub menu of default value
00	Return (End of default)
01	key-on mode
02	Language
03	Unit
04	With/without service cir.

- 3) Mode to be selected as key is turned ON
Following operation allows specifying the working mode to be displayed on the machine monitor as the starting key is turned ON.



- P-mode, E-mode, L-mode and B-mode: If any of above modes is specified, that mode will be constantly turned ON as the starting switch is pressed.
- The mode that had been selected as the starting key was turned off in the last operation: This setting turns ON the last used mode as the starting switch is pressed.
- Default: This setting turns ON the delivered default mode (P-mode) as the starter switch is pressed.

- ★ If the engine is stopped from B-mode on a machine equipped with the attachment, this mode will be invariably selected as the starter switch is turned ON the next time independent of above setting.

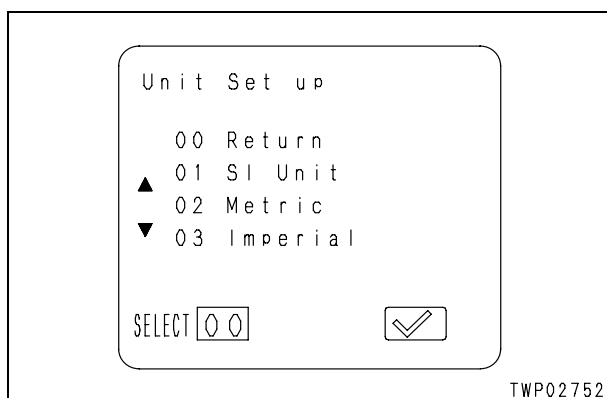
4) Language setting function
Service Menu allows switching the language between Japanese and English.



- ★ The default language of the machine monitor is English.
- ★ When using the machine monitor, which is a spare part, in the Japanese-speaking sphere, switch this function from English to Japanese.

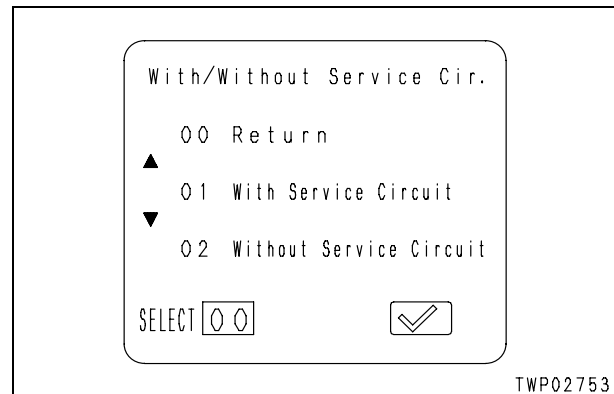
5) Unit selection function
You can select one from the three units to be used in the monitoring function display of Service Menu.

- ★ SI unit system is the default setting of the machine monitor.



6) Function for selecting distinction of "With/Without Service Cir".
It is possible in this function to set a distinction between with or without attachment.

- With Service Circuit: When an attachment is installed.
- Without Service Circuit: When no attachment is installed.



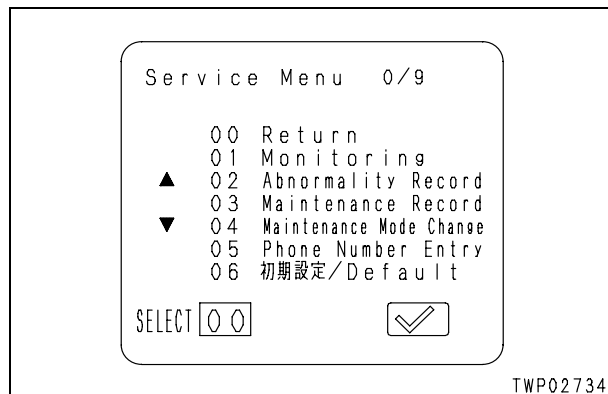
- ★ When the attachment is installed, you must select "With Service Circuit" from this screen. Otherwise, the selection function (the function for sharing the attachment) won't be available from the operator mode.

22. Function of adjustment [07]

The operator can adjust various items related to the machine with the machine monitor.

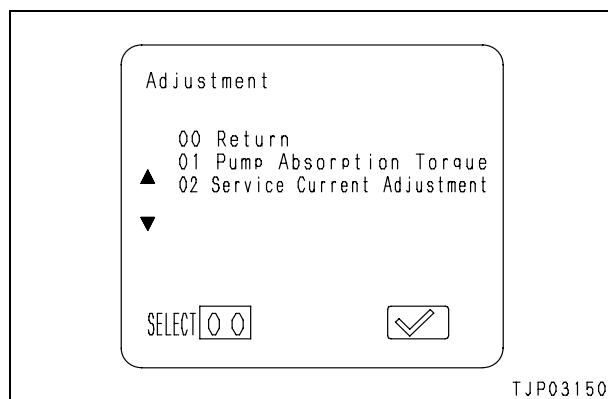
1) Menu selection

Select "07 Adjustment" menu from the Service Menu initial screen and then depress [✓] switch.



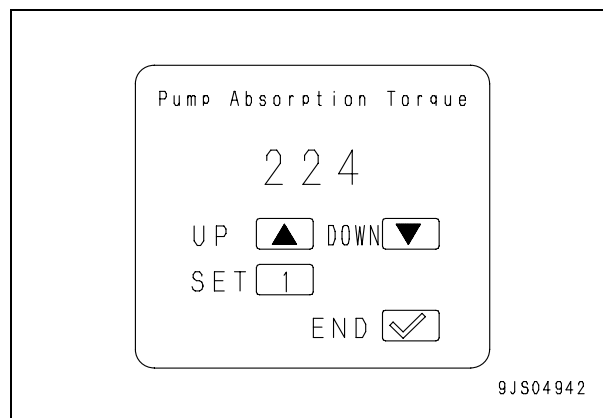
2) Sub menu selection

Select the sub menu on which setting change is to be done and then press [✓] switch.



3) Function for Pump Absorption Torque Adjustment

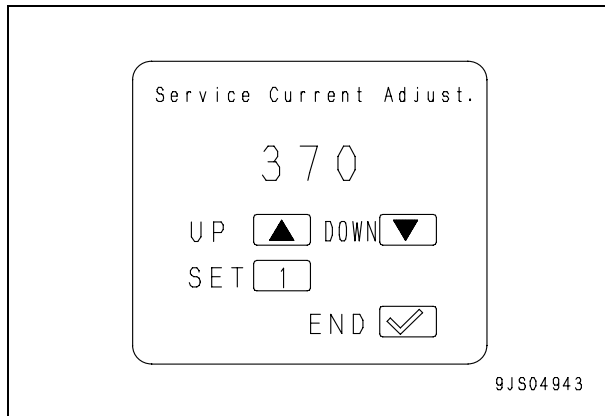
The pump absorption torque can be adjusted within the range shown in the table below.



Adjustment value	Torque adjustment value
220	+4.0 kgm
221	+3.0 kgm
222	+2.0 kgm
223	+1.0 kgm
224	0.0 kgm
225	-1.0 kgm
226	-2.0 kgm
227	-3.0 kgm
228	-4.0 kgm

Num ber	Adjustment of sub menu
00	Return (Ends the adjustment)
01	Pump absorption torque
02	Service current adjustment

- 4) Function for Adjustment of Flow for Attachment in Compound Operation
The distribution of oil flow for attachments in compound operation can be adjusted within the range shown in the table below.

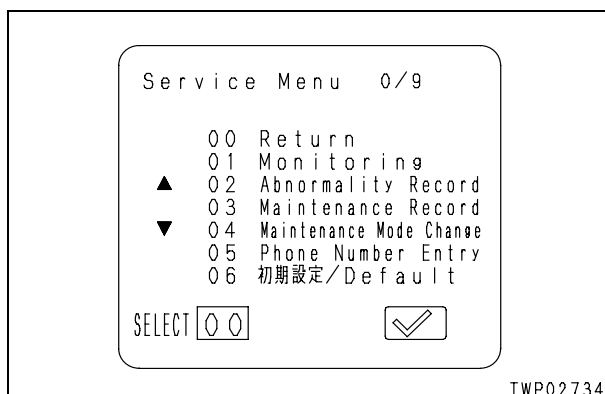


Adjustment value	Distribution of oil flow to attachment
370	0.5 Time
371	0.7 Time
372	1.0 Time
373	0.4 Time

23. Function of cylinder cut out operation [08]

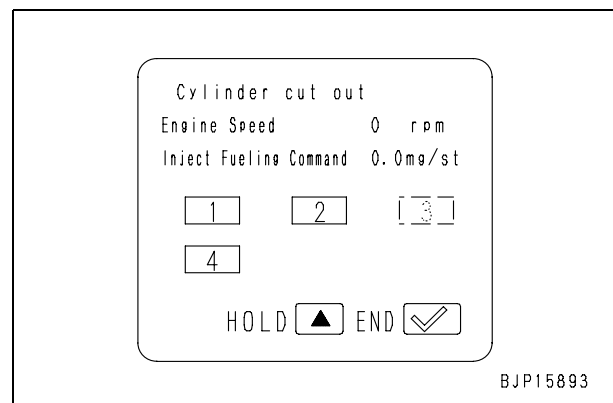
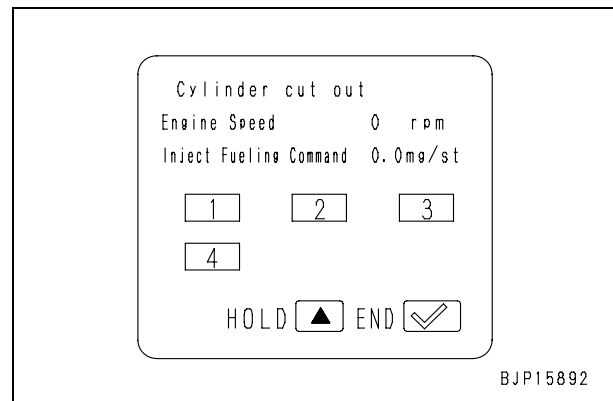
The operator can perform the engine on cylinder cut out operation with the machine monitor. "Cylinder cut out" operation means to run the engine with 1 or more fuel injectors disabled electrically to reduce the number of effective cylinders. This operation is used to find out a cylinder which does not output power normally (combustion in it is abnormal).

- 1) Selecting menu
Select "08 Cylinder cut out" menu from the service menu initial screen and press [✓] switch.



- 2) Selecting cylinder to be disabled
Press a switch corresponding to the cylinder No. to be disabled from switches [1] to [4] of the machine monitor.

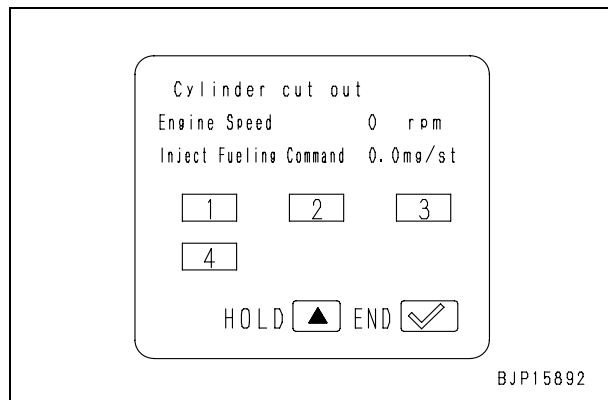
- ★ If pressing the switch changes the cylinder number on the screen to a white letter enclosed in the white frame, the cylinder is disabled (when a wrong number is selected, press the correct switch again).
- ★ Number of cylinders to be reduced is any.



3) Resetting cut out cylinder

Press the switch corresponding to the disabled cylinder number from switches [1] to [4] of the machine monitor to be reset.

- ★ If pressing the switch changes the cylinder number on the screen to a black letter enclosed in the black frame, the cylinder is reset.

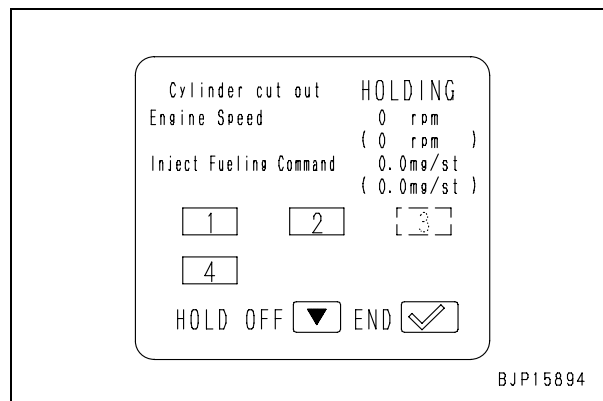
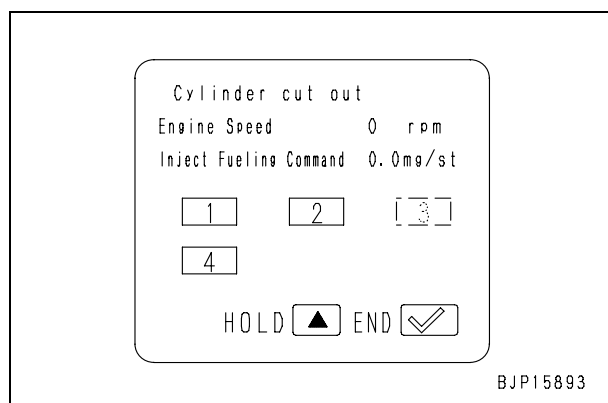


4) Engine speed holding function

Pressing [△] switch while the engine operation on cylinder cut out screen is turned on holds the engine speed and its speed is newly displayed in the lower space.

Pressing [▽] switch during holding cancels the holding function and deletes the display in the lower space.

- ★ If the holding function is used, the held speed is displayed in the lower space along with () and the upper space continuously displays the current speed.
- ★ The holding function is usable independent of the currently set mode – the cylinder cut out or not.

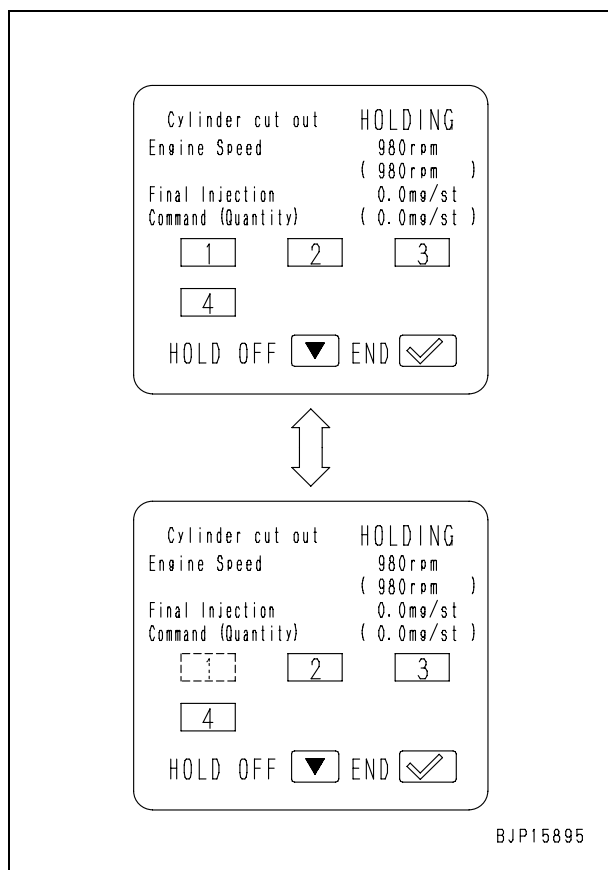


[Reference]: Using the holding function effectively

The engine speed being displayed on the screen through the holding function remains on it until the holding is cancelled. In other words, enabling or disabling of the cylinder cut out mode does not affect the display.

Thus, when identifying a failed cylinder quicker, following operation is effective.

- (1) Run the engine from the normal operation mode (no cylinder cut out) and then hold the speed of that time.
 - (2) Specify the cylinder to be diagnosed as the cut out.
 - (3) Run the engine under the same condition as that for (1). Then compare the engine speed at that time and the held speed being displayed to diagnose the cylinder.
 - (4) Reset a cut out cylinder independent of the fluctuations in the engine speed.
 - (5) Repeat above steps (2) to (4) and then compare the results against that obtained from other cylinders.
- ★ If the diagnosis identified a cylinder on which there was no decrease in the engine speed or the decrease was small, it can be safely judged that there must be some abnormalities in its fuel.



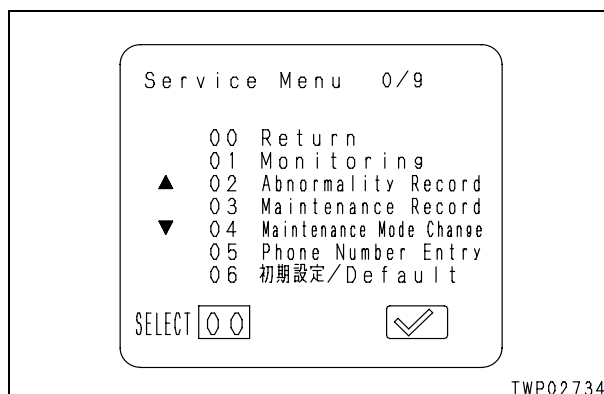
24. Function of no injection cranking [09]

No injection cranking of the engine is available from the machine monitor.

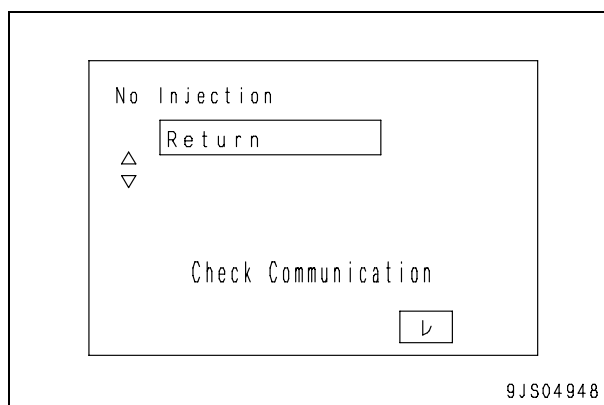
No injection cranking refers to preventing the injector from injecting fuel until lubricant reaches respective parts by cranking engine with the starting motor when restarting the engine after storage for an extended period of time.

- ★ No injection cranking can be applied to measuring compression pressure.
- ★ This setting must be done after stopping the engine.

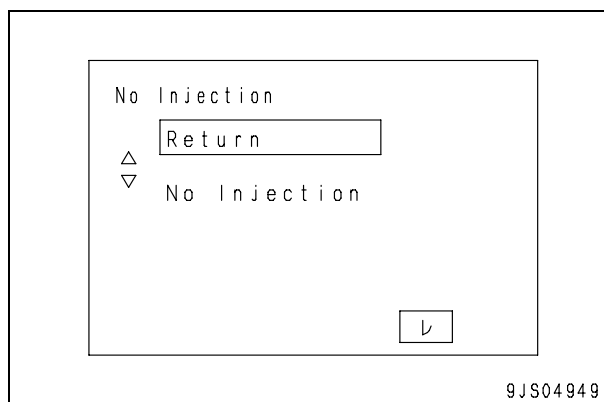
- 1) Selecting menu
Select "09 No Injection Cranking" from the service menu initial screen and press [✓] switch.



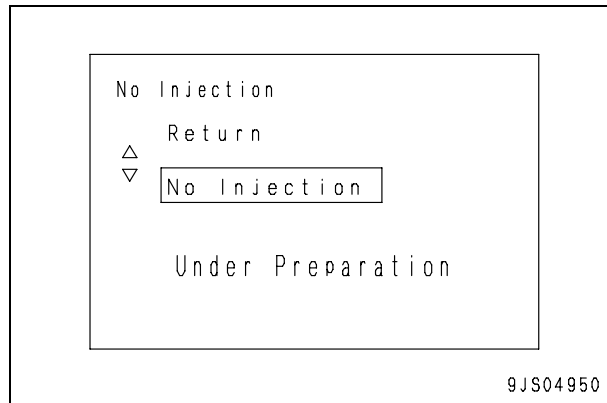
- 2) The initial screen for the no injection cranking will appear.
★ "Check Communication" will be displayed in red.



- 3) As the checkup is over, following screen appears.

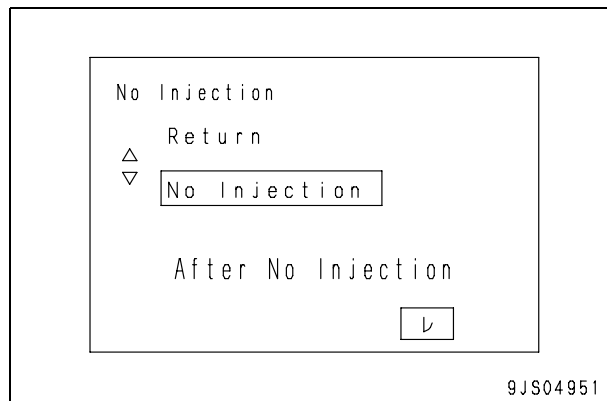


- 4) Select "No Injection" and press [✓] switch. "Under Preparation" will be displayed on the screen.
 ★ The letters "Under Preparation" are displayed in red.



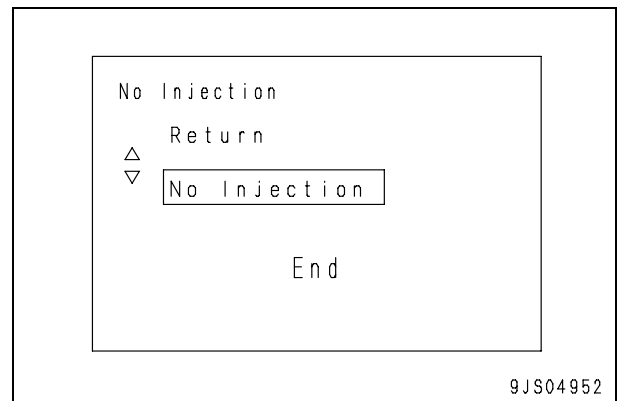
- 5) As the preparation for no injection cranking is completed, display of "Under Preparation" is replaced with "After No Injection".
 ★ The letters "After No Injection" are displayed in green.
 6) From this state, crank the engine using the starting motor.

⚠ Limit the cranking time to 20 seconds to protect the starting motor.

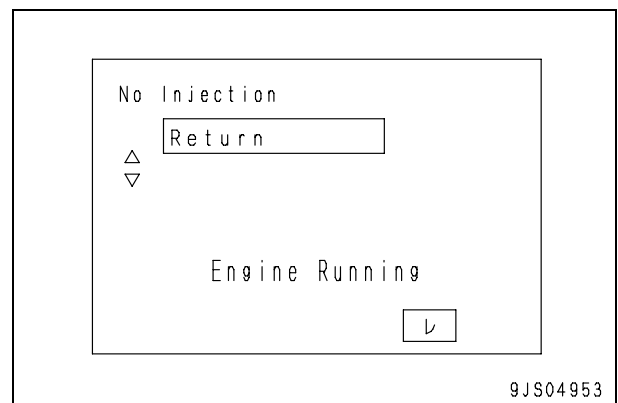


- 7) After the no injection cranking is over, press [✓] switch from the previous screen and the letters "End" will be displayed for 3 seconds.
 ★ The letters "End" are displayed in green.

- 8) Press "Return" when ending the no injection cranking.



- ★ If the no injection cranking function is inadvertently selected while the engine is running, "Engine Running" will appear as No Injection in step 4) is selected. This "Engine Running" display remains on the screen even after the engine is stopped. Restoring the service menu screen alone deletes the display.



Handling voltage circuit of engine controller

1. The starting switch must be turned OFF before disconnecting or connecting the connector across the engine controller and engine.
2. It is prohibited to start the engine for diagnosis purpose when a T-adapter is inserted in or connected to the connector across the engine controller and engine.
 - ★ You may turn the starting switch to the OFF or ON position but must not turn it to the START position.

Procedure for turning on KOMTRAX terminal

When the machine is delivered, KOMTRAX terminal is installed:

- ★ When the machine is delivered, KOMTRAX terminal is installed (machine with the standard equipment), implement the following procedure.

1. Reporting of machine model, model number and serial number

Report the machine model, model number and serial number to the person responsible to operation of KOMTRAX.

2. Registration of KOMTRAX terminal

The person responsible to operation of KOMTRAX shall register the subject terminal using the KOMTRAX client PC.

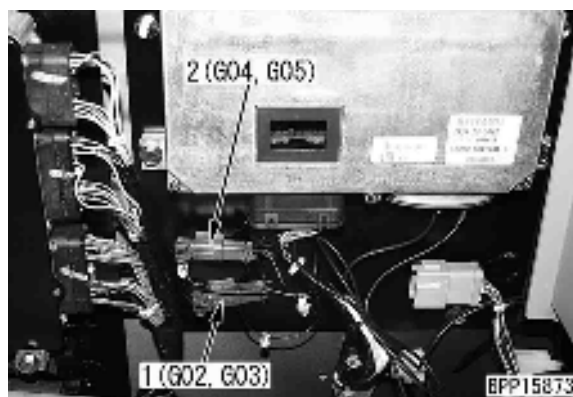
- ★ See "KOMTRAX administrator manual" for the procedure.
- ★ Above completes the necessary operations.

When installing KOMTRAX terminal after the machine is delivered:

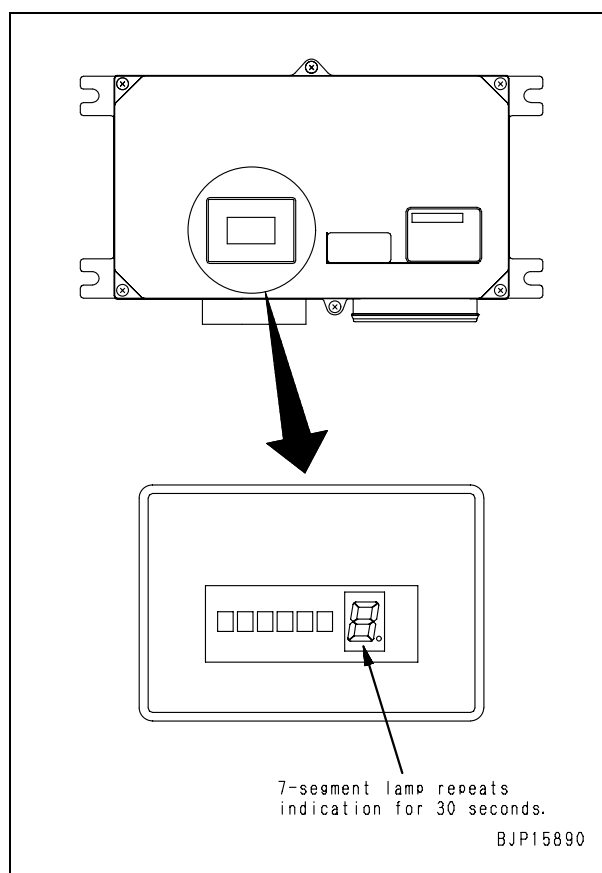
- ★ When installing KOMTRAX terminal after the machine is delivered (machine with the retrospective equipment), implement the following procedure.

1. Station opening inspection

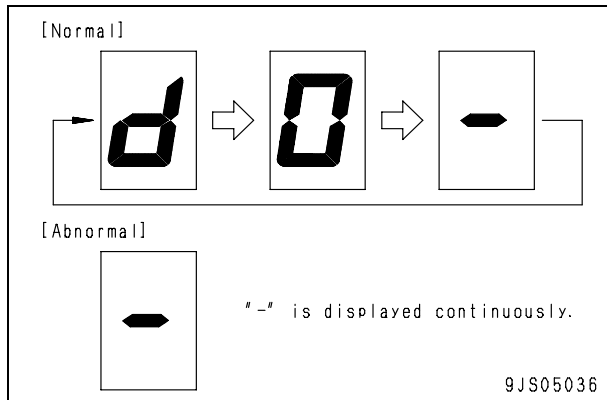
- ★ Referencing "Preparation work for trouble-shooting of electrical system", confirm the position of KOMTRAX terminal and the inspecting connector (the inspecting connector is provided at the bottom of KOMTRAX terminal).
 - ★ Finish the operations of steps 4) to 7) within 30 seconds.
- 1) Turn OFF the starting switch and then, after making sure 5 seconds have elapsed, proceed to the next step.
 - 2) Make sure visually that the inspecting connectors 1 and 2 are connected.
 - Inspecting connector 1:
G02 (female) and G03 (male)
 - Inspecting connector 2:
G04 (female) and G05 (male)



- 3) Disconnect the inspecting connector 1 and maintain that state for 5 seconds.
- 4) Turn ON the starting switch and maintain that state for 5 seconds.
- 5) Disconnect the inspecting connector 2 and maintain that state for 5 seconds.
- 6) Connect the inspecting connector 1 again and maintain that state for 5 seconds.
- 7) Connect the inspecting connector 2 again and maintain that state for 5 seconds.
- 8) Make sure that the KOMTRAX terminal 7-segment indicator lamp is normally turned on.



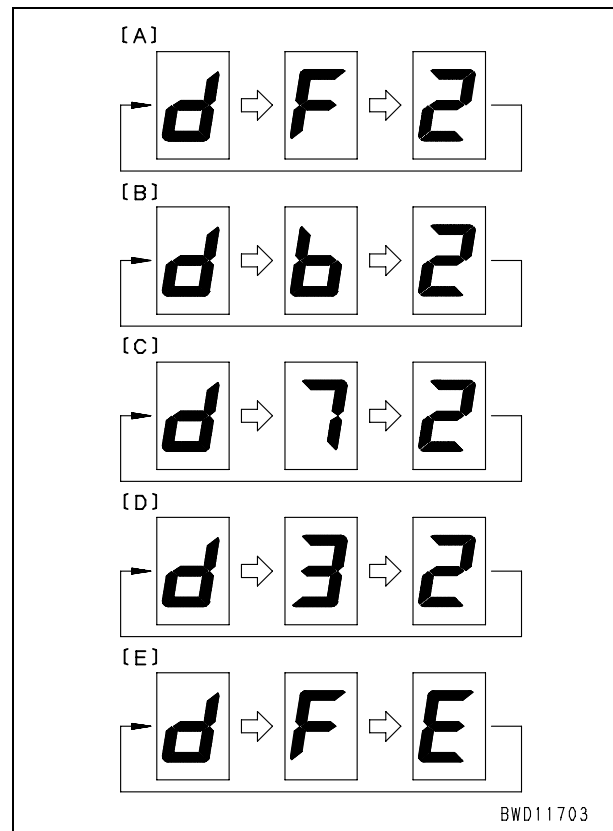
- ★ As [Normal] is indicated, proceed to the next step.
- ★ If [Abnormal] is indicated, repeat the procedure from step 1).



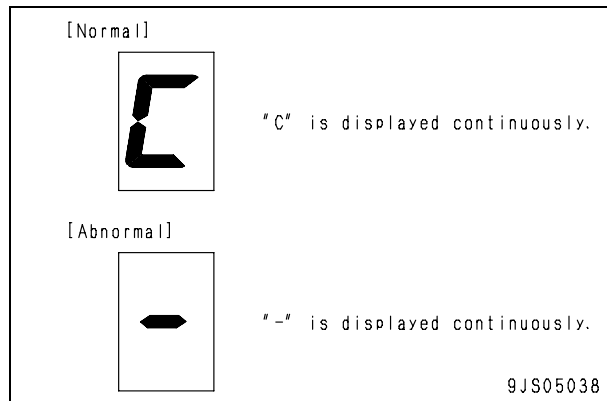
- 9) Set the starting switch to START position and maintain it in that state for 5 seconds. Make sure the engine is not started.
 - ★ If the engine is started, repeat the procedure from step 1).
- 10) Return the starting switch to ON position and maintain that state for 5 seconds.
 - ★ Don't return it to OFF position.
- 11) Set the starting switch to START position again and make sure the engine is started.
- 12) Make sure that the KOMTRAX terminal 7 - segment indicator lamps are normally turned on.

- ★ As [A: Normal] is confirmed, proceed to the next step (it will take 90 seconds to 15 minutes until normal display is restored).
- ★ If [B: GPS position data sensing error] were displayed, check the GPS antenna and cable for external troubles. If any, repair the trouble and repeat the procedure from step 1).
- ★ If [C: Receiving error] were displayed, check the communication antenna and cable for external troubles. If any, repair the trouble and repeat the procedure from step 1).
- ★ If [D: GPS position data sensing error and receiving error] were displayed, check the GPS antenna and cable as well as the communication antenna and cable for external troubles. If any, repair the trouble and repeat the procedure from step 1).

- ★ If [E: Network error] were displayed, check the indication of [LED-C4] referencing "KOMTRAX terminal lamp indications". (When CAN is not recognized, check KOMTRAX terminal CAN harness for troubles. If any, repair the trouble and repeat the procedure from step 1)).

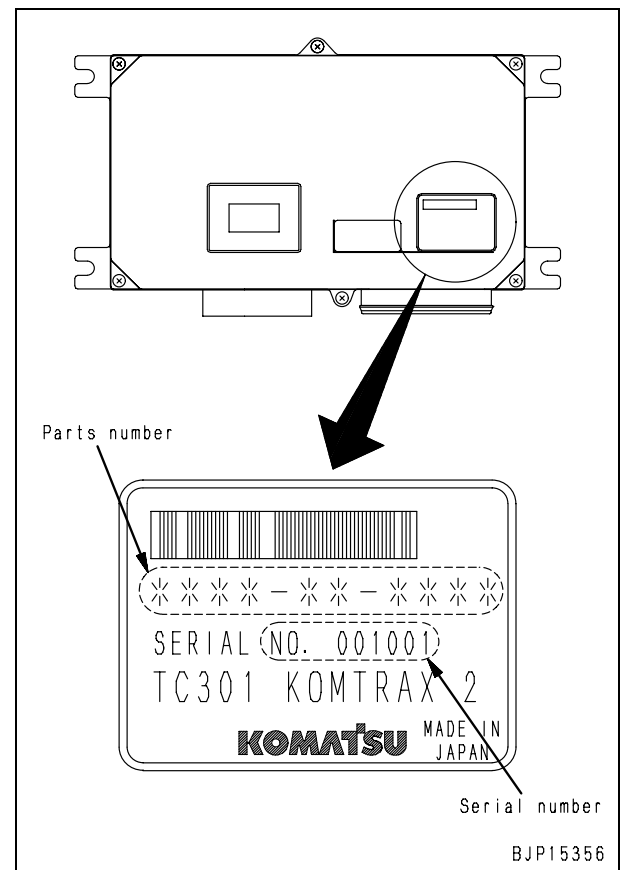


- 13) Turn the starting switch OFF.
- 14) Make sure that the 7-segment indicator lamp comes on normally in 5 seconds.
 - ★ As [Normal] is displayed, the station opening inspection is complete.
 - ★ If [Abnormal] is displayed, the inspection is incomplete and must be repeated from step 1).



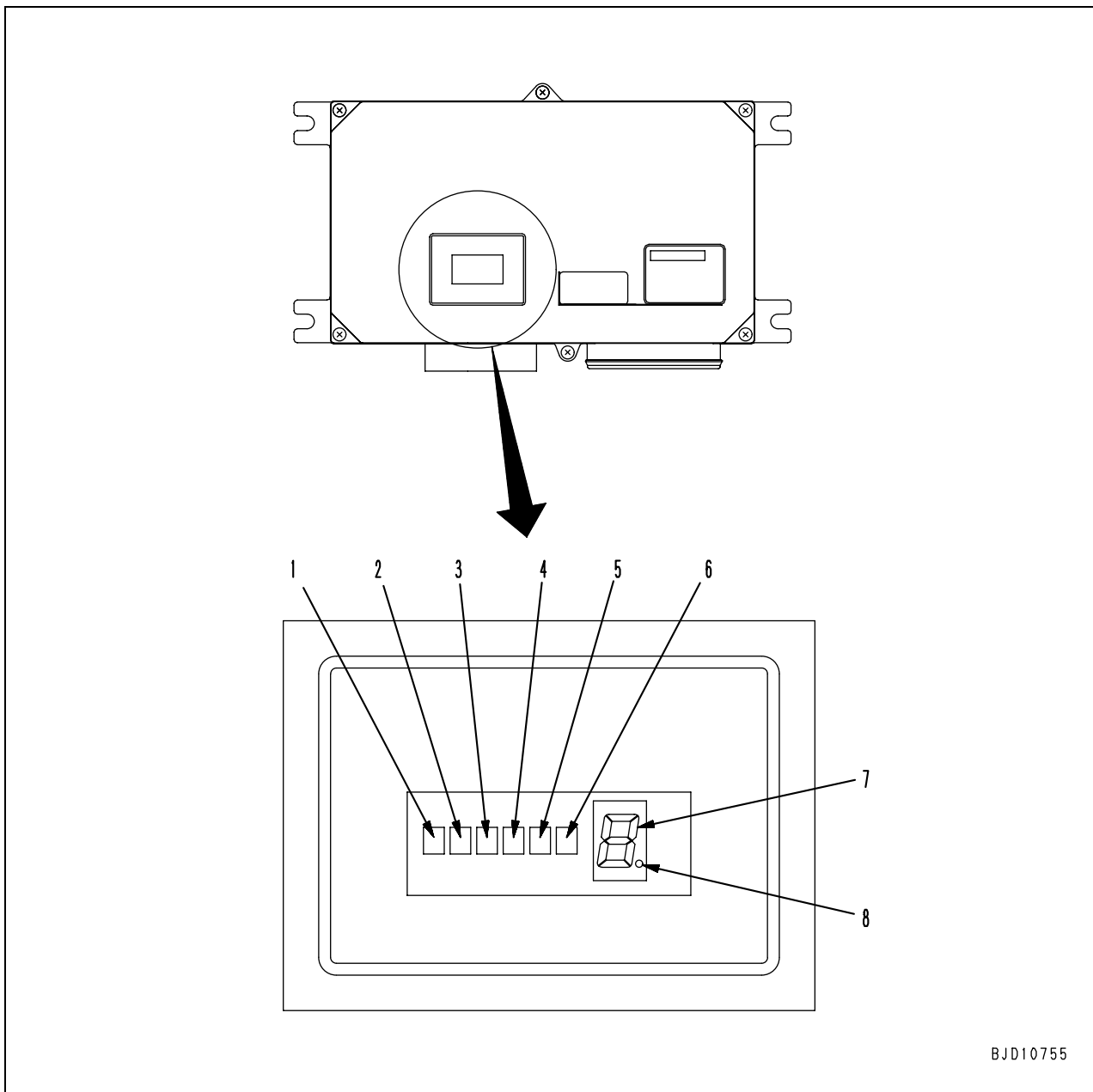
2. Application for start of use

- ★ The application for start of use is allowed only after the terminal station opening inspection has been successfully ended.
- 1) Concerning the machine for which the station opening inspection has been completed, report the following information to the person responsible to operation of KOMTRAX.
 - (1) Information of the machine for which the station opening inspection has been completed (machine model, model number and serial number)
 - (2) Part number and serial number of KOMTRAX terminal
 - (3) The service meter reading when KOMTRAX terminal was installed (in 0.1 h unit)



- 2) The person responsible to operation of KOMTRAX shall register the machine using the KOMTRAX client PC.
 - ★ See "KOMTRAX administrator manual" for the procedure.
 - ★ Above completes the necessary operations.

Indication by KOMTRAX terminal lamps



LEDs for CPU

1. LED-C1 (R signal and ACC signal)
2. LED-C2 (Condition of starting output)
3. LED-C3 (Condition of S-NET and C signal)
4. LED-C4 (Condition of CAN)
5. LED-C5 (Download writing condition)
6. LED-C6 (Download writing condition)

7-segment lamp and dot for CPU

7. 7-segment lamp (Number of males which are not sent yet)
8. Dot (Measuring condition of GPS)

The KOMTRAX system indicates the information in the system and contents of processing with the LED display unit at the top of the KOMTRAX terminal. Accordingly, if the system seems to have a trouble, carry out the following checks.

- Check of antennas
- Check of terminal LEDs

Before using the KOMTRAX system, you must complete application for start of use and inspection of the machine for starting use.

Check of antennas

- ★ Before checking the indication of the LED unit, check that the communication antenna and GPS antenna are free from abnormality.
- The communication antenna must not be off the position and must not be broken.
- The communication antenna cable must not be disconnected and must be connected to the KOMTRAX terminal normally.
- The GPS antenna must not be off the position and must not be broken.
- The GPS antenna cable must not be disconnected and must be connected to the KOMTRAX terminal normally.

Check of terminal LEDs

1. Contents of indication of LEDs for CPU

- ★ When checking the indication of the LEDs, turn the starting switch to the ON or START position or run the engine.

No.	LED	Name/Function	Indication (*1)	Contents of indication
1	LED-C1	Starting switch ACC signal and alternator R signal	ON	Starting switch ACC signal: ON, Alternator R signal: ON
			Quick blink	Starting switch ACC signal: OFF, Alternator R signal: ON
			Slow blink	Starting switch ACC signal: ON, Alternator R signal: OFF
			OFF	Starting switch ACC signal: OFF, Alternator R signal: OFF
2	LED-C2	Condition of engine control signal	ON	Engine control signal: ON
			OFF	Engine control signal: OFF
3	LED-C3	Condition of S-NET connection and starting switch C signal	ON	S-NET: Connected, Starting switch C signal: OFF
			Quick blink	Starting switch C signal: ON
			Slow blink	(Unused)
			OFF	S-NET: Disconnected, Starting switch C signal: OFF
4	LED-C4	Condition of CAN connection	ON	CAN: Installed, (Fuel sensor: Not installed)
			Quick blink	CAN: Installed, (Fuel sensor: Installed)
			Slow blink	CAN: Not installed, (Fuel sensor: Installed)
			OFF	CAN: Not installed, (Fuel sensor: Not installed)
5	LED-C5	Condition of download writing	Either is ON	Download writing mode (Special function of system administrator)
6	LED-C6		Both are OFF	Normal operation mode

*1: Types of blink and blinking interval

Quick blink: Blinking at intervals of about 1 second

Slow blink: Blinking at intervals of about 4 seconds

2. Contents of indication of 7-segment lamp and dot for CPU

★ When checking the indication of the LEDs, turn the starting switch to the ON position.

No.	Indicator	Name/Function	Indication (*2)	Contents of indication
7	7-segment lamp	Number of mails which are not sent yet and satellite capturing condition	Lighting of 0 – 9	Figure indicates number of mails which are not sent yet (When 10 or more mails are not sent yet, 9 is indicated). Lighting indicates that satellite is captured.
			Quick blink of 0 – 9	Figure indicates number of mails which are not sent yet (When 10 or more mails are not sent yet, 9 is indicated). Quick blink indicates that satellite is not captured.
8	Dot	Measuring condition of GPS	ON	GPS has completed measuring (Position is recognized. See *3.)
			OFF	GPS has not completed measuring (Position is not recognized. See *3.)

*2: Types of blink and blinking interval

Quick blink: Blinking at intervals of about 1.0 seconds

Slow blink: Blinking at intervals of about 4.0 seconds

*3: Remarks on measuring condition of GPS

Even in an outdoor place where the radio waves are strong enough, it may take more than 1 minute to complete measurement after the starting switch is turned ON. If the radio waves are very weak or no radio waves are received, the GPS cannot measure the position.

Preparation work for troubleshooting of electrical system

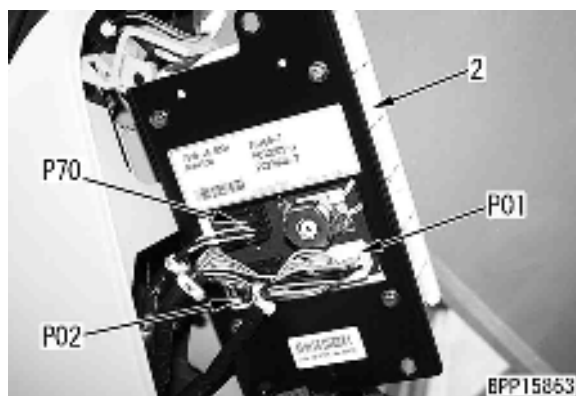
- ★ When troubleshooting the electric circuit related to the machine monitor, pump controller, engine controller or KOMTRAX terminal, expose the related connectors according to the following procedure.

1. Machine monitor

- 1) Take off cover (1).
 - ★ The cover is fixed with two upper and lower clips. Pull it up for the removal.
 - ★ If the sunlight sensor is equipped for an air conditioner, disconnect **P15** connector at the cover rear side.



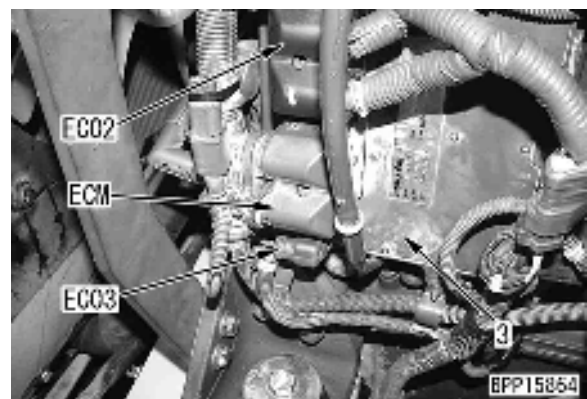
- 2) Remove the 3 mounting screws to disconnect machine monitor (2) from the mount.
 - ★ Take care so that the screws may not fall into the console.
- 3) Insert or connect troubleshooting T-adaptor in or to connectors **P01**, **P02**, and **P70** of machine monitor.



2. Engine controller

- ★ The engine controller is installed in the left side of the engine.
- 1) Open the engine hood.
 - 2) Insert or connect troubleshooting T-adaptor in or to connectors ECM, EC02 and EC03 of engine controller (3).
 - ★ Connectors are fixed with screw. Loosen the screws before disconnecting them.
 - ★ When returning the connectors back to their position, tighten them to the specified torque.

⌘ Screw: **2.82 Nm {0.288 kgm}**



3. Pump controller

- ★ The pump controller is installed in the cover situated in the rear side of the operator seat.
- 1) Remove the cover from the rear of the operator seat, referring to the section for KOMTRAX terminal.
 - 2) Remove cover (4).



- 3) Insert or connect troubleshooting T-adapter in or to connectors **CP01**, **CP02** and **CP03** of pump controller (5).

- ★ Connectors are fixed with screws. Loosen the screws before disconnecting them.
- ★ When returning the connectors back to their position, tighten them to the specified torque.

🔧 Screw: **2.82 Nm {0.288 kgm}**



4. KOMTRAX terminal

- ★ KOMTRAX terminal is installed in the cover situated in the rear side of the operator seat.

- 1) Remove cover (4).

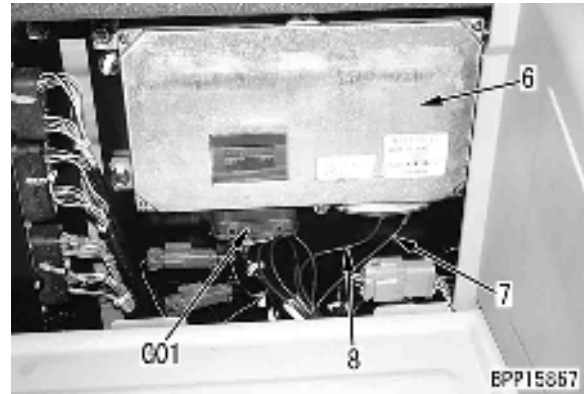


- 2) Insert or connect troubleshooting T-adapter in or to connector **G01** of KOMTRAX terminal (6).

- ★ The connectors are fixed with screws. Loosen the screws before disconnecting them.
- ★ When returning the connectors to their original positions, fix them by tightening the screws with the specified torque.

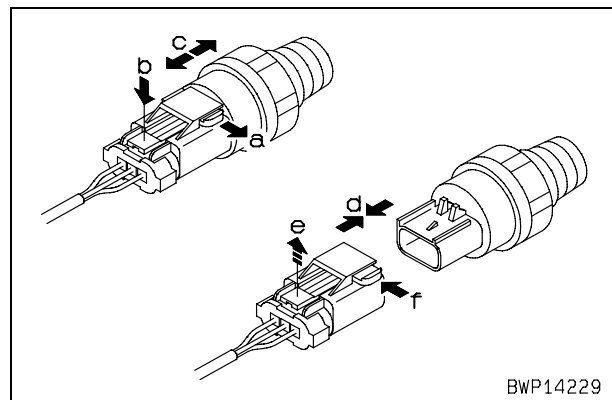
🔧 Screw: **2.82 Nm {0.288 kgm}**

- ★ Cable (7) is used for the communication antenna (2 systems).
- ★ Cable (8) is used for the GPS antenna.



5. Removing and installing the atmospheric pressure and temperature sensor, and position sensor (cam and crank)

- Removal
Shift the lever in the arrowhead direction (a) and pull it out while pushing lock (b).
- Installation
Insert the connector and then shift the lever in the arrowhead direction (f).





Pm - Clinic Service

Model	Serial No.	Service meter reading
<input type="checkbox"/> PC160LC-7E0 PC180LC/NLC-7E0		h

User's name	Implemented on:	Inspected by:
	/ /	

Specifications		
Work equipment	Attachment	Shoe width
Boom <input type="checkbox"/> Standard <input type="checkbox"/> () Arm <input type="checkbox"/> Standard <input type="checkbox"/> () Bucket <input type="checkbox"/> Standard <input type="checkbox"/> ()	<input type="checkbox"/> Breaker <input type="checkbox"/> ()	<input type="checkbox"/> 600 mm <input type="checkbox"/> 700 mm <input type="checkbox"/> ()

Oil and coolant level check		
<input type="checkbox"/> Radiator coolant <input type="checkbox"/> Engine oil <input type="checkbox"/> Hydraulic oil	As required <input type="checkbox"/> Damper case oil <input type="checkbox"/> Machinery case oil	<input type="checkbox"/> Machinery <input type="checkbox"/> ()
Max. range of engine coolant temperature	Max. range of hydraulic oil temperature	Ambient temperature
 BWP10817	 BWP10818	°C Elevation m

Operator's comment

Result of visual check

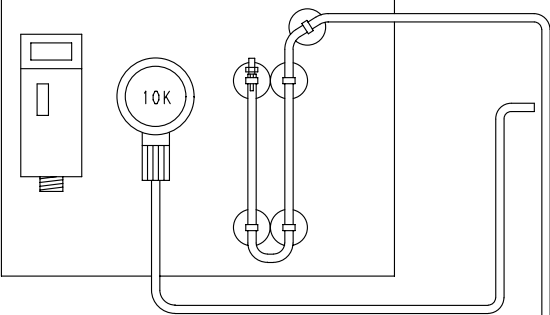
Failure code history			
Electrical system		Mechanical system	
<div> <div></div> <div>h</div> </div> <div>Content:</div> <div> <div></div> <div>h</div> </div> <div>Content:</div> <div> <div></div> <div>h</div> </div> <div>Content:</div> <div> <div></div> <div>h</div> </div> <div>Content:</div> <div> <div></div> <div>h</div> </div> <div>Content:</div>	AA10NX Air cleaner Clogging AB00KE Charge Voltage Low B@BAZG Eng. Oil Press. Low B@BAZK Eng. Oil Level Low B@BCNS Eng. Water Overheat B@BCZK Eng. Water Level Low B@HANS Hydr. Oil Overheat	Frequency <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div>	SMR at initial occurrence <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div>

Engine


Engine speed

Engine oil pressure

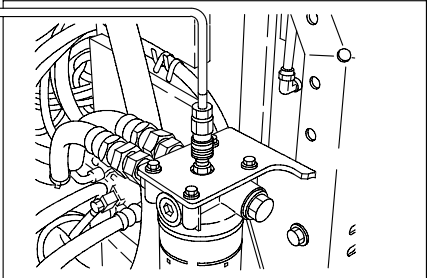
Blow-by pressure



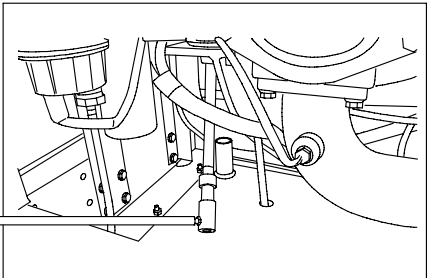
Engine Speed (monitoring:01002)



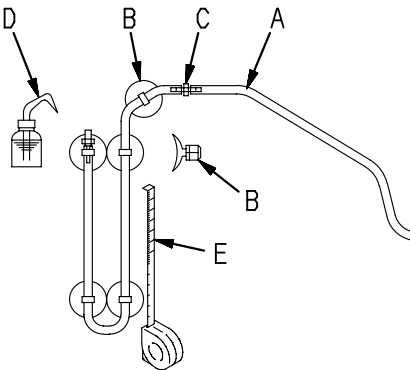
Engine oil pressure



Blow-by pressure



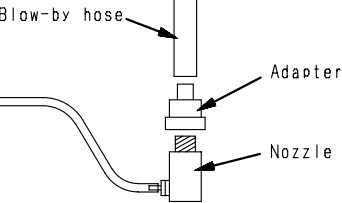
	Part Name	Q'ty
A	Vinyl hose (4m)	1
	Vinyl hose (1m)	1
B	Suction cup	5
C	Joint	2
D	Feeder	1
E	Tape measure	1



Blow-by hose

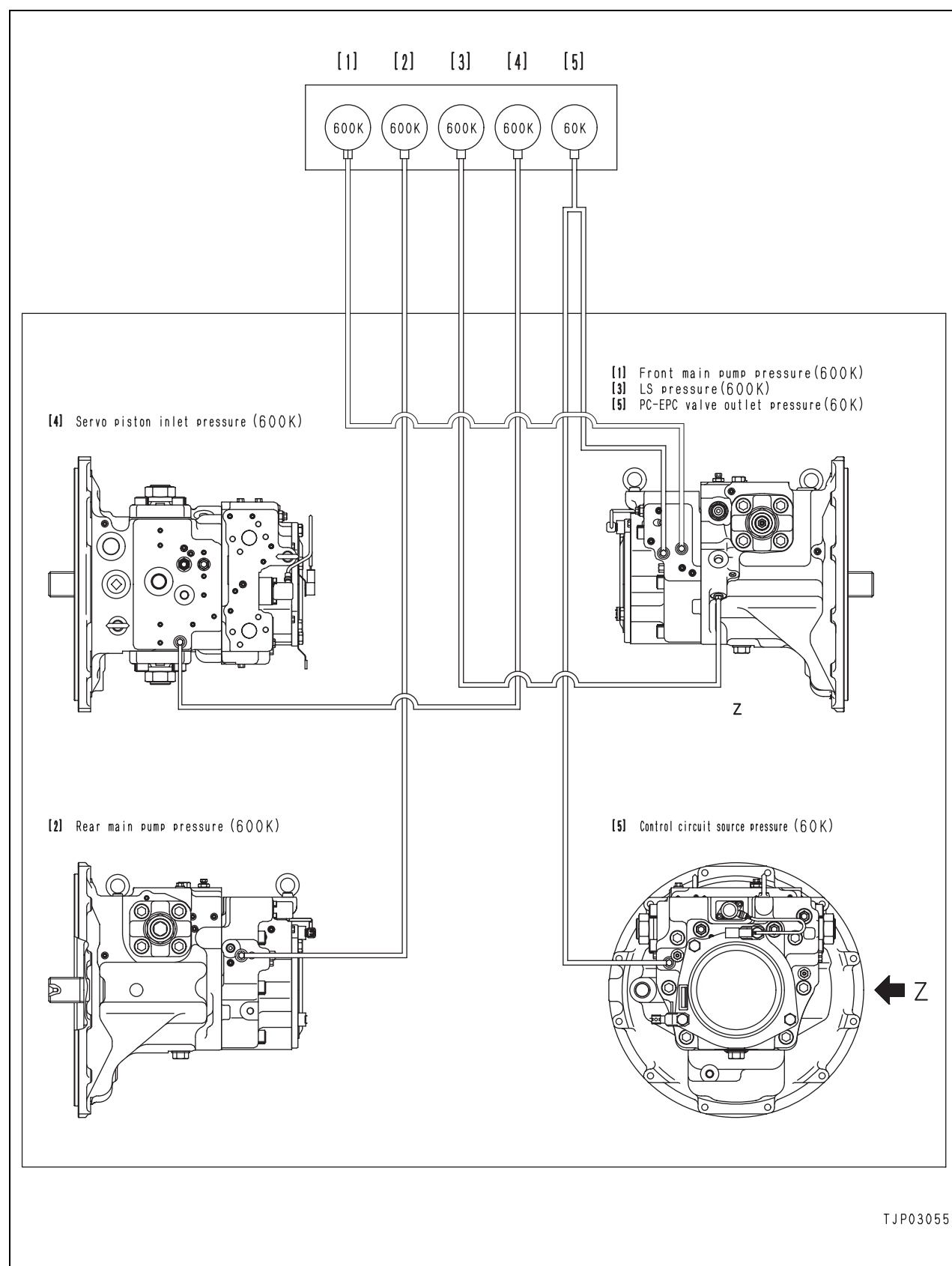
Adapter

Nozzle



BJP15889

Hydraulic system



Check sheet

Model	Serial No.	Service meter	User's name	Date of execution	Inspector
PC160LC-7E0 PC180LC/NLC-7E0				/ /	

1. Engine

No.	Check item	Checking condition					Unit	Standard value for new machine	Service limit value	Measured value	Good	Bad	
		Fuel control dial	Working mode	Auto-deceleration	Power maximizing	Operation of work equipment							
1	Engine speed	High idle	P	OFF	ON	Arm IN lever slightly operated + power maximizing	rpm	2,250 – 2,390	2,250 – 2,390				
2	Engine oil pressure					MPa {kg/cm ² }	Min. 0.29 {Min. 3.0}	0.25 {2.6}					
3	Engine speed	Low idle			OFF	OFF	All levers in neutral	rpm	1,000 – 1,100	1,000 – 1,100			
4	Engine oil pressure						MPa {kg/cm ² }	Min. 0.10 {Min. 1.0}	0.07 {0.7}				
5	Engine speed	High idle			ON	Arm IN relief	rpm	2,045 – 2,245	2,045 – 2,245				
6	Blow-by pressure						kPa {mmH ₂ O}	Max. 0.98 {Max. 100}	1.96 {200}				
7	Engine speed			ON			OFF	All levers in neutral	rpm	1,300 – 1,500	1,300 – 1,500		

2. Work equipment speed

No.	Check item		Checking condition				Unit	Standard value for new machine	Service limit value	Measured value	Good	Bad			
			Fuel control dial	Work-ing mode	Checking posture, etc.										
1	Boom RAISE (*1)		High idle	P	Work equipment extended fully		sec	3.1 – 3.9	Max. 4.9						
2	Arm OUT (*1)				Boom top horizontal		sec	2.5 – 3.1	Max. 3.5						
3	Arm IN (*1)			E			sec	3.1 – 3.7	Max. 4.5						
4							sec	3.2 – 4.0	Max. 4.8						
5							L	sec	3.7 – 4.5	Max. 5.3					
6	Bucket CURL			P	Boom top horizontal Arm cylinder retracted fully			sec	2.3 – 2.9	Max. 3.5					
7	Swing (5 turns)	Right			Work equipment extended fully Swing right and left		sec	22.5 – 27.5	Max. 30						
		Left													
8	Travel (5 idle turns)						One side of track pushed up and turned forward and backward	LO	Right Left	sec	39.9 – 48.7	39.9 – 50.7			
			HI	Right Left				sec							

*1. Unit the cylinder cushion starts working

3. Work equipment hydraulic drift amount

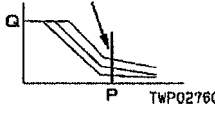
Hydraulic oil temperature (45 – 55°C)

No.	Check item	Checking condition			Unit	Standard value for new machine	Service limit value	Measured value	Good	Bad
		Fuel control dial	Working mode	Checking posture, etc.						
1	Hydraulic drift amount at bucket tooth tip (15 min)	Engine stop		Boom top horizontal Arm cylinder retracted fully Bucket loaded	mm	600	Max. 900			

4. Inspection of hydraulic circuit

4. Inspection of hydraulic circuit							(1)	(2)	(3)	(4)	(5)	
No.	Part to be checked	Condition setting					600kg/cm ²	600kg/cm ²	600kg/cm ²	600kg/cm ²	60kg/cm ²	Remarks
		Fuel dial	Working mode	Auto-decel-erator	One-touch power max. switch	Work equipment operation	F pump main pressure	R pump main pressure	LS pressure	Serve inlet pressure	Control circuit pressure	
1	Self-reducing valve	Hi idle	P	OFF	OFF	Neutral						Circuit pressure 3.1MPa {32kg/cm ² }
2	Main relief valve					Arm OUT relief						35.1 → 37.8MPa {358 → 385kg/cm ² }
3	Main relief valve (When power increased)				ON							
4	LS valve (LS differential pressure valve)				OFF	Neutral						Main – LS = 4.5MPa {46kg/cm ² } (LS differential pressure ≒ Unload pressure)
						Travel Lever at FULL while bucket is CURL						Main – LS = 2.2MPa {22.5kg/cm ² } (LS differential pressure)
							Swing lock switch ON	Right relief				
Left relief												
6	Main relief valve, Travel safety valve, Travel junction valve					Track shoe locked	Left forward					37.8MPa {385kg/cm ² }
							Left reverse					
							Right forward					
							Right reverse					
7	Servo					Arm IN relief						Main – servo pressure balance (4) / (1) = (4) / (2) ≒ 3/5

↓ Connection to be changed to hoses (5)

No.	Part to be checked	Condition setting					(1)	(2)	(3)	(4)	(5)	Remarks <Reference valve: kg/cm ² >
		Fuel dial	Working mode	Auto-decel-erator	One-touch power max. switch	Work equipment operation	F pump main pressure	R pump main pressure	LS pressure	Serve inlet pressure	PC-EPC pressure	
8	PC-EPC valve	Low	P	OFF	OFF	Neutral						<34> Delivery variance by switching modes <6> <10> <13> <12>  TWP02760
		Full	E									
			L									
			B									

PC160LC-7E0, PC180LC/NLC-7E0 Hydraulic excavator

Form No. UEN02110-00

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HYDRAULIC EXCAVATOR

PC160LC-7E0
PC180LC-7E0
PC180NLC-7E0

Machine model	Serial number
PC160LC-7E0	K45001 and up
PC180LC-7E0	K45001 and up
PC180NLC-7E0	K45001 and up

40 Troubleshooting

Failure code table and fuse locations

Failure code table	2
Fuse locations	5

Failure code table

User code	Failure code	Trouble (Displayed on screen)	Device in charge	Category of record	Reference documents No.
—	AA10NX	Air cleaner clogging	MON	Mechanical system	Troubleshooting by failure code, Part 1 SEN02113-00
—	AB00KE	Charge voltage low	MON	Mechanical system	
—	B@BAZG	Eng. oil press. low	MON	Mechanical system	
—	B@BAZK	Eng. oil level low	MON	Mechanical system	
—	B@BCNS	Eng. coolant overheat	MON	Mechanical system	
—	B@BCZK	Eng. coolant level low	MON	Mechanical system	
—	B@HANS	Hydr. oil overheat	MON	Mechanical system	
E10	CA111	EMC critical internal failure	ENG	Electrical system	
E10	CA115	Eng. Ne and bkup speed sens error	ENG	Electrical system	
E11	CA122	Chg air press sensor high error	ENG	Electrical system	
E11	CA123	Chg air press sensor low error	ENG	Electrical system	
E14	CA131	Throttle sensor high error	ENG	Electrical system	
E14	CA132	Throttle sensor low error	ENG	Electrical system	
E15	CA144	Coolant temp sens high error	ENG	Electrical system	
E15	CA145	Coolant temp sens low error	ENG	Electrical system	
E15	CA153	Chg air temp sensor high error	ENG	Electrical system	
E15	CA154	Chg air temp sensor low error	ENG	Electrical system	
E11	CA155	Chg air temp high speed derate	ENG	Electrical system	
E15	CA187	Sens supply 2 volt low error	ENG	Electrical system	
E11	CA221	Ambient press sens high error	ENG	Electrical system	
E11	CA222	Ambient press sens low error	ENG	Electrical system	
E15	CA227	Sens supply 2 volt high error	ENG	Electrical system	
—	CA234	Eng. overspeed	ENG	Mechanical system	
E15	CA238	Eng. Ne speed sens supply volt error	ENG	Electrical system	
E10	CA271	IMV/PCV1 short error	ENG	Electrical system	
E10	CA272	IMV/PCV1 open error	ENG	Electrical system	
E11	CA322	Inj #1 (L#1) open/short error	ENG	Electrical system	
E11	CA324	Inj #3 (L#3) open/short error	ENG	Electrical system	
E11	CA331	Inj #2 (L#2) open/short error	ENG	Electrical system	Troubleshooting by failure code, Part 2 SEN02114-00
E11	CA332	Inj #4 (L#4) open/short error	ENG	Electrical system	
E10	CA342	Calibration code incompatibility	ENG	Electrical system	
E10	CA351	Injectors drive circuit error	ENG	Electrical system	
E15	CA352	Sens supply 1 volt low error	ENG	Electrical system	
E15	CA386	Sens supply 1 volt high error	ENG	Electrical system	
E15	CA428	Water in fuel sensor high error	ENG	Electrical system	
E15	CA429	Water in fuel sensor low error	ENG	Electrical system	
E15	CA435	Engine oil dress sw error	ENG	Electrical system	
E10	CA441	Battery voltage low error	ENG	Electrical system	
E10	CA442	Battery voltage high error	ENG	Mechanical system	
E11	CA449	Rail press very high error	ENG	Electrical system	
E11	CA451	Rail press sensor high error	ENG	Electrical system	
E11	CA452	Rail press sensor low error	ENG	Electrical system	

User code	Failure code	Trouble (Displayed on screen)	Device in charge	Category of record	Reference documents No.
E11	CA488	Chg air temp high torque derate	ENG	Electrical system	Troubleshooting by failure code, Part 2 SEN02114-00
E15	CA553	Rail press high error	ENG	Electrical system	
E15	CA559	Rail press low error	ENG	Electrical system	
E15	CA689	Eng. Ne speed sensor error	ENG	Electrical system	
E15	CA731	Eng. bkup speed sens phase error	ENG	Electrical system	
E10	CA757	All persistent data lost error	ENG	Electrical system	
E15	CA778	Eng. bkup speed sensor error	ENG	Electrical system	
E0E	CA1633	KOMNET datalink timeout error	ENG	Electrical system	
E14	CA2185	Throt sens sup volt high error	ENG	Electrical system	
E14	CA2186	Throt sens sup volt low error	ENG	Electrical system	
E11	CA2249	Rail press very low error	ENG	Electrical system	
E11	CA2311	IMV solenoid error	ENG	Electrical system	
E15	CA2555	Grid htr relay volt high error	ENG	Electrical system	
E15	CA2556	Grid htr relay volt low error	ENG	Electrical system	
—	D110KB	Battery relay drive S/C	PUMP	Electrical system	Troubleshooting by failure code, Part 3 SEN02115-00
—	D196KA	Service return relay disc.	PUMP	Electrical system	
—	D196KB	Service return relay S/C	PUMP	Electrical system	
E0E	DA22KK	Pump solenoid power low error	PUMP	Electrical system	
E02	DA25KP	Press. sensor power abnormality	PUMP	Electrical system	
E0E	DA2RMC	Pump comm. abnormality	PUMP	Electrical system	
—	DA2SKQ	Model selection abnormality	PUMP	Electrical system	
E0E	DAFRMC	Monitor comm. abnormality	PUMP	Electrical system	
—	DGH2KB	Hydr oil sensor short	MON	Electrical system	
—	DHPAMA	F pump press sensor abnormality	PUMP	Electrical system	
—	DHPBMA	R pump press sensor abnormality	PUMP	Electrical system	
—	DHSAMA	Swing RH PPC press sensor abnormality	PUMP	Electrical system	
—	DHSBMA	Swing LH PPC press sensor abnormality	PUMP	Electrical system	
—	DW43KA	Travel speed sol. disc.	PUMP	Electrical system	Troubleshooting by failure code, Part 4 SEN02116-00
—	DW43KB	Travel speed sol. S/C	PUMP	Electrical system	
E03	DW45KA	Swing brake sol. disc.	PUMP	Electrical system	
E03	DW45KB	Swing brake sol. S/C	PUMP	Electrical system	
—	DW91KA	Travel junction sol. disc.	PUMP	Electrical system	
—	DW91KB	Travel junction sol. S/C	PUMP	Electrical system	
—	DWJ0KA	Merge-divider sol. disc	PUMP	Electrical system	
—	DWJ0KB	Merge-divider sol. S/C	PUMP	Electrical system	
—	DWK0KA	2-stage relief sol. disc.	PUMP	Electrical system	
—	DWK0KB	2-stage relief sol. S/C	PUMP	Electrical system	
E02	DXA0KA	PC-EPC sol. disc.	PUMP	Electrical system	
E02	DXA0KB	PC-EPC sol. S/C	PUMP	Electrical system	
—	DXE4KA	Service current EPC disc.	PUMP	Electrical system	
—	DXE4KB	Service current EPC S/C	PUMP	Electrical system	
—	DY20KA	Wiper working abnormality	PUMP	Electrical system	
—	DY20MA	Wiper parking abnormality	PUMP	Electrical system	
—	DY2CKB	Washer drive S/C	PUMP	Electrical system	

User code	Failure code	Trouble (Displayed on screen)	Device in charge	Category of record	Reference documents No.
—	DY2DKB	Wiper drive (for) S/C	PUMP	Electrical system	Troubleshooting by failure code, Part 4 SEN02116-00
—	DY2EKB	Wiper drive (rev) S/C	PUMP	Electrical system	

- ★ This table lists the failed sections in the order of the failure code.
- ★ Those failure codes to which the corresponding number is not indicated in the user code space are not displayed on the ordinary screen if a failure is found. They are just recorded in the failure record (electrical system and mechanical system) of the service menu.
- ★ The category of record is used for indicating to which of the electrical and mechanical system of the service menu's abnormality record a given failure is classified.
- ★ **E** at beginning of the user code indicates the following state.
 - With **E**: The failure still remains without being resolved.
 - Without **E**: The failure is already resolved.

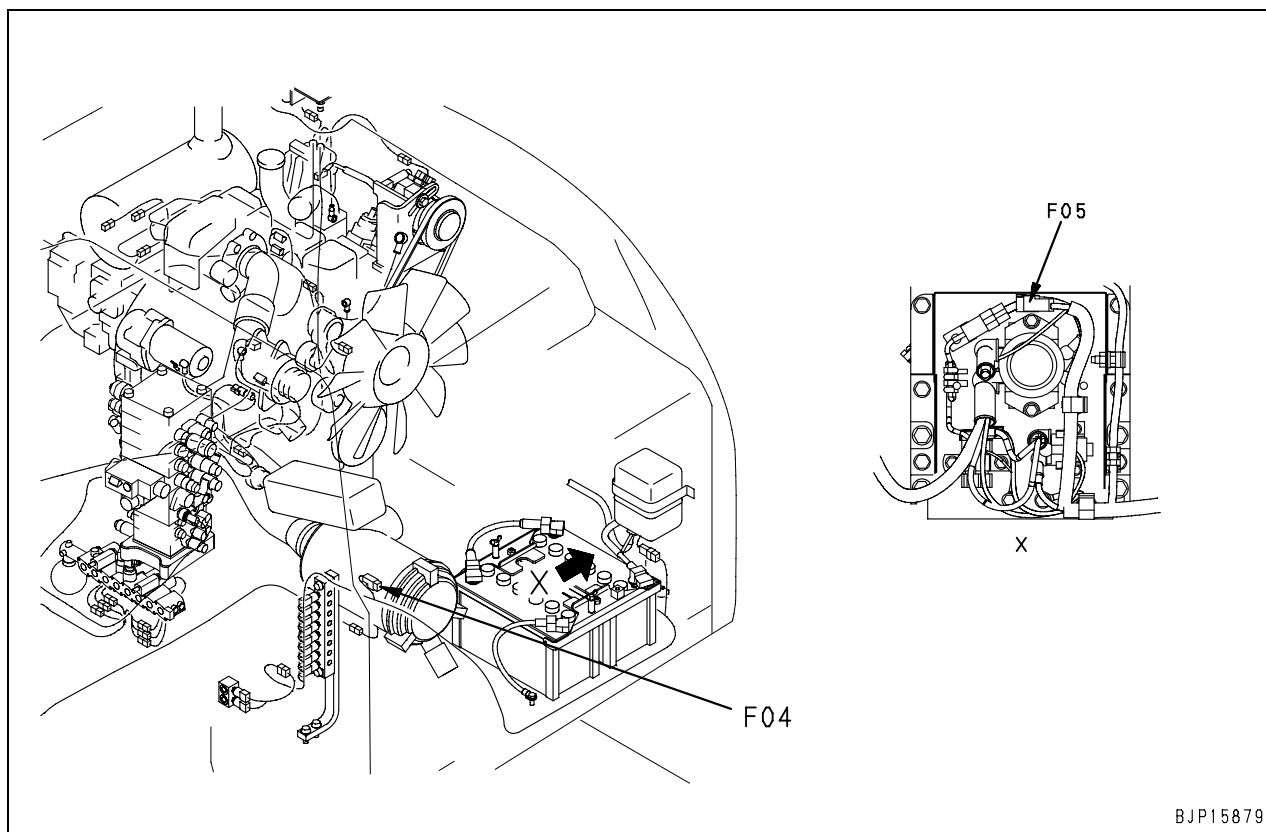
Fuse locations

Connection table of fuse box

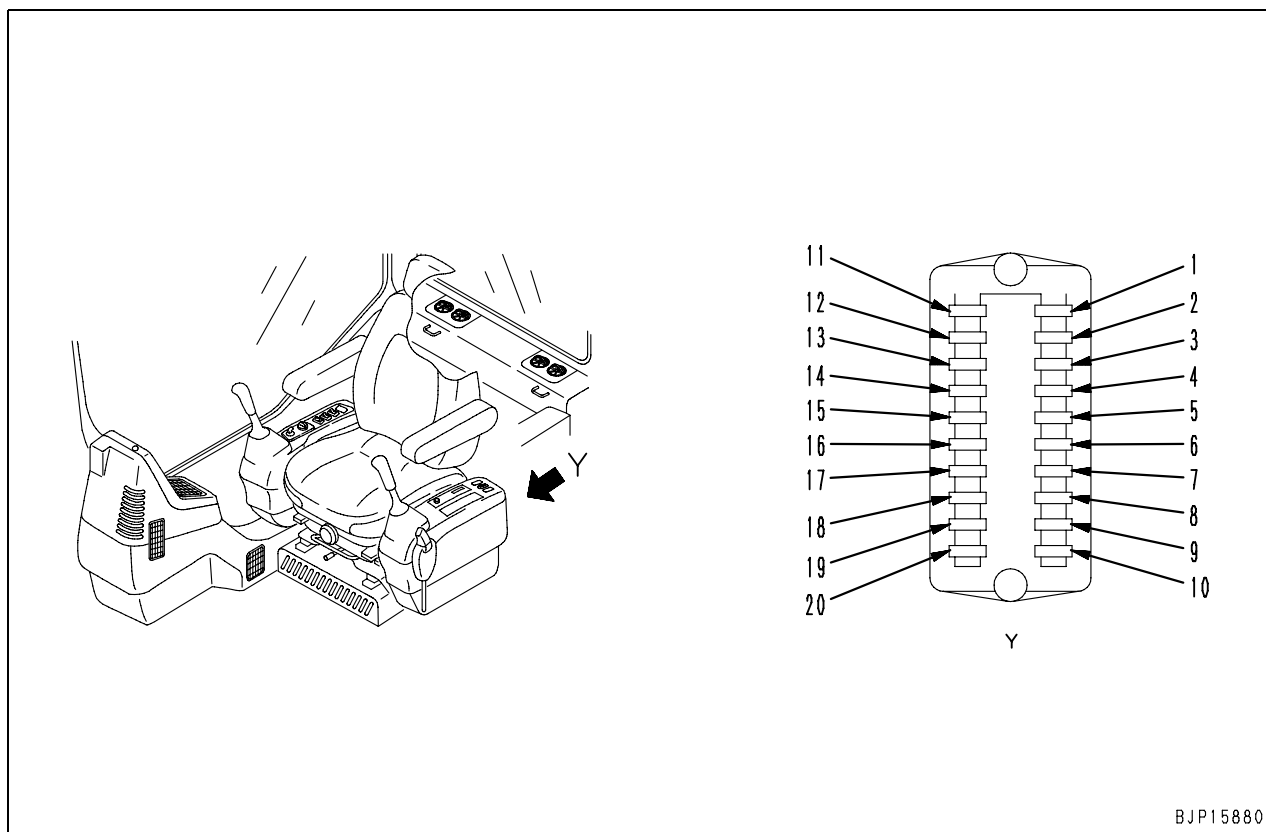
- ★ This connection table shows the devices to which each power supply of the fuse box supplies power (A switch power supply is a device which supplies power while the starting switch is in the ON position and a constant power supply is a device which supplies power while the starting switch is in the OFF and ON positions).
- ★ When carrying out troubleshooting related to the electrical system, you should check the fuses and fusible links to see if the power is supplied normally.

Type of power supply	Fusible link	Fuse No.	Fuse capacity	Destination of power
Switch power supply	F04 (65A)	1	10A	Swing parking brake release switch
				Emergency pump resistor
		2	20A	Pump controller (Solenoid power supply)
		3	20A	Starting motor cut-out relay (PPC lock)
				Machine monitor
				Wiper motor
		4	10A	Cigarette lighter
				Windshield washer motor
5	10A	Horn switch		
Switch power supply	F04 (65A)	6	10A	Relay for auto preheat
				Lower wiper
		7	10A	Rotary lamp
		8	10A	Right headlamp, working lamp (boom), working lamp (rear)
		9	10A	Radio
				Left knob switch (pump controller input)
		10	10A	Refuel pump
				Revo work lamp
Switch power supply	F04 (65A)	11	20A	Air conditioner unit
				Air conditioner compressor relay
				Air conditioner blower relay
		12	20A	(Spare)
		13	20A	Lamp switch
		14	10A	Optional power supply (1)
		15	10A	Travel alarm
				Optional power supply (2)
Constant power supply	F05 (30A)	16	10A	Radio (backup power supply)
				Cab lamp
				12v power supply
		17	20A	Starting switch (B)
				Machine monitor
				Pump controller
		18	10A	(Spare)
		19	30A	Engine controller
Switch power supply	Starting switch ACC	20	5A	Engine controller (ACC signal)

Locations of fusible links



Location of fuse box and fuse Nos.



PC160LC-7E0, PC180LC/NLC-7E0 Hydraulic excavator

Form No. UEN02111-00

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HYDRAULIC EXCAVATOR

PC160LC-7E0

PC180LC-7E0

PC180NLC-7E0

Machine model Serial number

PC160LC-7E0	K45001 and up
PC180LC-7E0	K45001 and up
PC180NLC-7E0	K45001 and up

40 Troubleshooting

General information on troubleshooting

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T-adapter box and T-adapter table.....	40

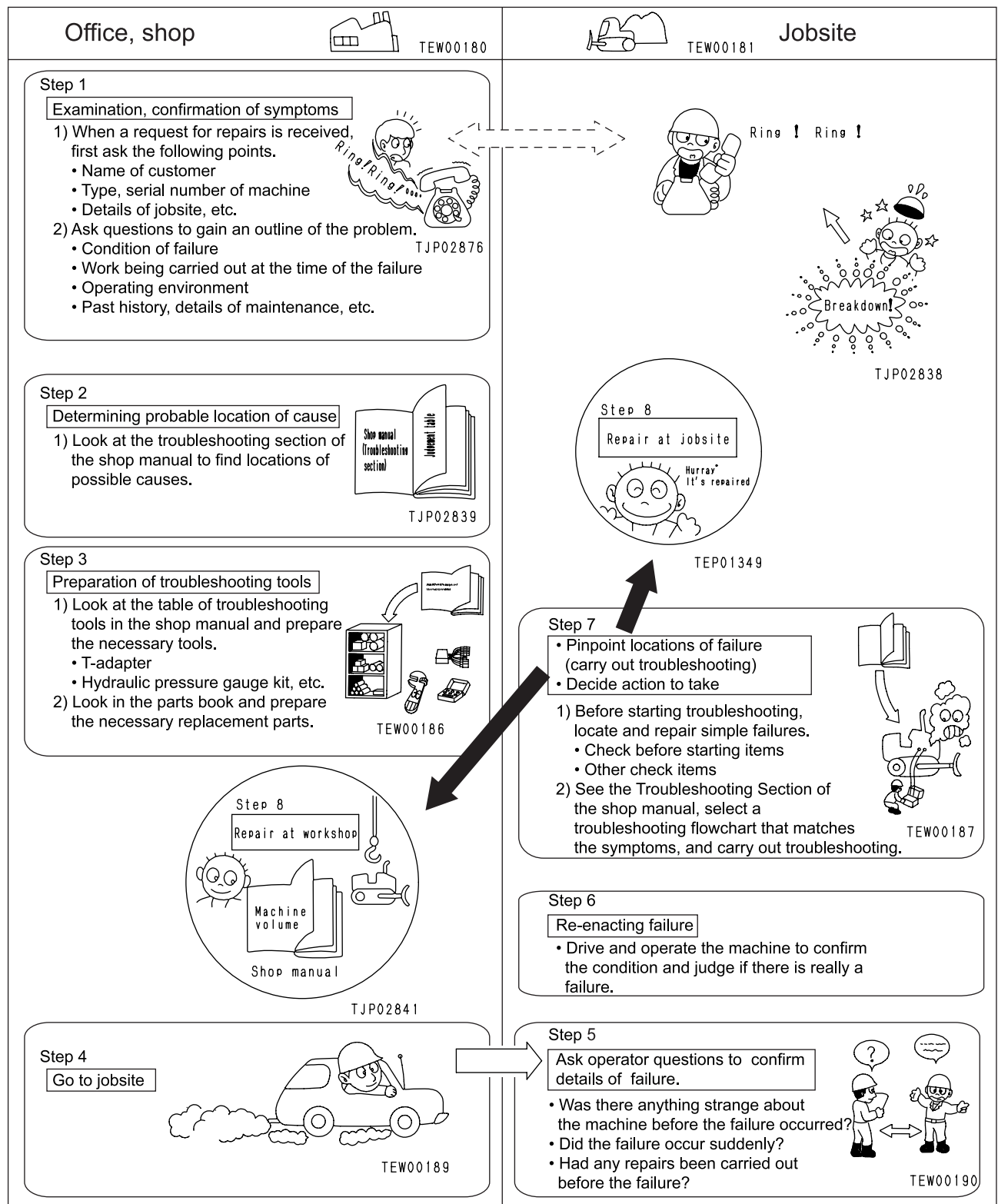
Points to remember when troubleshooting

- ⚠ Stop the machine in a level place, and check that the safety pin, blocks, and parking brake are securely fitted.
- ⚠ When carrying out the operation with 2 or more workers, keep strictly to the agreed signals, and do not allow any unauthorized person to come near.
- ⚠ If the radiator cap is removed when the engine is hot, hot water may spurt out and cause burns, so wait for the engine to cool down before starting troubleshooting.
- ⚠ Be extremely careful not to touch any hot parts or to get caught in any rotating parts.
- ⚠ When disconnecting wiring, always disconnect the negative (–) terminal of the battery first.
- ⚠ When removing the plug or cap from a location which is under pressure from oil, water, or air, always release the internal pressure first. When installing measuring equipment, be sure to connect it properly.

The aim of troubleshooting is to pinpoint the basic cause of the failure, to carry out repairs swiftly, and to prevent re occurrence of the failure. When carrying out troubleshooting, an important point is of course to understand the structure and function. However, a short cut to effective troubleshooting is to ask the operator various questions to form some idea of possible causes of the failure that would produce the reported symptoms.

1. When carrying out troubleshooting, do not hurry to disassemble the components.
If components are disassembled immediately any failure occurs:
 - Parts that have no connection with the failure or other unnecessary parts will be disassembled.
 - It will become impossible to find the cause of the failure.
 It will also cause a waste of man-hours, parts, or oil or grease, and at the same time, will also lose the confidence of the user or operator. For this reason, when carrying out troubleshooting, it is necessary to carry out thorough prior investigation and to carry out troubleshooting in accordance with the fixed procedure.
2. Points to ask user or operator
 - 1) Have any other problems occurred apart from the problem that has been reported?
 - 2) Was there anything strange about the machine before the failure occurred?
 - 3) Did the failure occur suddenly, or were there problems with the machine condition before this?
 - 4) Under what conditions did the failure occur?
 - 5) Had any repairs been carried out before the failure? When were these repairs carried out?
 - 6) Has the same kind of failure occurred before?
3. Check before troubleshooting
 - 1) Is there any sign of irregularities of the machine?
 - 2) Make checks before starting day's work.
 - 3) Make checks of other items.
- 4) Other maintenance items can be checked externally, so check any item that is considered to be necessary.
4. Confirming failure
Confirm the extent of the failure yourself, and judge whether to handle it as a real failure or as a problem with the method of operation, etc.
 - ★ When operating the machine to re-enact the troubleshooting symptoms, do not carry out any investigation or measurement that may make the problem worse.
5. Troubleshooting
Use the results of the investigation and inspection in Items 2 – 4 to narrow down the causes of failure, then use the troubleshooting table or troubleshooting flowchart to locate the position of the failure exactly.
 - ★ The basic procedure for troubleshooting is as follows.
 - 1] Start from the simple points.
 - 2] Start from the most likely points.
 - 3] Investigate other related parts or information.
6. Measures to remove root cause of failure
Even if the failure is repaired, if the root cause of the failure is not repaired, the same failure will occur again. To prevent this, always investigate why the problem occurred. Then, remove the root cause.

Sequence of events in troubleshooting



Checks before troubleshooting

	Item	Criterion	Remedy
Lubricating oil/Coolant	1. Check of level and type of fuel	—	Add fuel
	2. Check of fuel for foreign matter	—	Clean and drain
	3. Check of fuel filter	—	Replace
	4. Check of hydraulic oil level	—	Add oil
	5. Check of hydraulic oil strainer	—	Clean and drain
	6. Check of swing machinery oil level	—	Add oil
	7. Check of level and type of engine oil (in oil pan)	—	Add oil
	8. Check of coolant level	—	Add coolant
	9. Check of dust indicator for clogging	—	Clean or replace
	10. Check of hydraulic oil filter	—	Replace
Electrical equipment	1. Check of battery terminals and wiring for looseness and corrosion	—	Re tighten or replace
	2. Check of alternator terminals and wiring for looseness and corrosion	—	Re tighten or replace
	3. Check of starting motor terminals and wiring for looseness and corrosion	—	Re tighten or replace
Hydraulic/Mechanical equipment	1. Check for abnormal noise and smell	—	Repair
	2. Check for oil leakage	—	Repair
	3. Bleeding air	—	Bleed air
Electric, electrical equipment	1. Check of battery voltage (with engine stopped)	20 – 30 V	Replace
	2. Check of electrolyte level	—	Add or replace
	3. Check of wires for discoloration, burn, and removal of cover	—	Replace
	4. Check for released wire clamp and drooping wire	—	Repair
	5. Check of wires for wetness (Check connectors and terminals for wetness, in particular)	—	Disconnect the connectors and dry
	6. Check of fuse for disconnection and corrosion	—	Replace
	7. Check of alternator voltage (while engine speed is at middle or higher)	After operating for several minutes: 27.5 – 29.5 V	Replace
	8. Check of battery relay for operating sound (when starting switch is turned ON or OFF)	—	Replace

Classification and troubleshooting steps

Classification of troubleshooting

Mode	Contents
Display of code	Troubleshooting by failure code
E-mode	Troubleshooting of electrical system
H-mode	Troubleshooting of hydraulic and mechanical system
S-mode	Troubleshooting of engine

Troubleshooting steps

If a problem that appears to be a failure occurs on the machine, identify the relevant troubleshooting No. by performing the following steps and proceed to the main body of troubleshooting.

- 1. Procedure for troubleshooting to be taken when user code is displayed on machine monitor:**
 When user code is displayed on machine monitor, press [✓] switch at panel switch section to display failure code.
 Carry out the troubleshooting for the corresponding [Display of code] according to the displayed failure code.
- 2. Procedure for troubleshooting to be taken when failure code is recorded in abnormality record:**
 If a user code is not displayed on the machine monitor, check a failure code with the abnormality record function of the machine monitor.
 If a code is recorded, carry out troubleshooting for the corresponding [Display of code] according to the recorded code.
 - ★ If an electrical system failure code is recorded, delete all the codes and reproduce them, and then see if the trouble is still detected.
 - ★ An error code of the mechanical system cannot be deleted.
- 3. Procedure for troubleshooting to be taken when user code is not displayed and no failure code is recorded in abnormality record:**
 If a user code is not displayed on the machine monitor and no failure code is recorded in the abnormality record, a trouble that the machine cannot find out by itself may have occurred in the electrical system or hydraulic and mechanical system.
 In this case, check the phenomenon looking like a trouble again and select the same phenomenon from the table of "Possible troubles and troubleshooting No.", and then carry out troubleshooting corresponding to that phenomenon in the "E-mode", "H-mode", or "S-mode".

Information in troubleshooting table

- ★ The following information is summarized in the troubleshooting table and the related electrical circuit diagram. Before carrying out troubleshooting, understand that information fully.

User code	Failure code	Trouble	Trouble name displayed in abnormality record machine monitor
Display on machine monitor	Display on machine monitor		
Contents of trouble	Contents of trouble detected by machine monitor or controller		
Action of machine monitor or controller	Action taken by machine monitor or controller to protect system or devices when engine controller detects trouble		
Problem that appears on machine	Problem that appears on machine as result of action taken by machine monitor or controller (shown above)		
Related information	Information related to detected trouble or troubleshooting		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Possible causes of trouble (Given numbers are reference numbers, which do not indicate priority)	<Contents of description> <ul style="list-style-type: none"> Standard value in normal state to judge possible causes Remarks on judgment
	2		<Troubles in wiring harness> <ul style="list-style-type: none"> Disconnection Connector is connected imperfectly or wiring harness is broken. Ground fault Wiring harness which is not connected to chassis ground circuit is in contact with chassis ground circuit. Hot short Wiring harness which is not connected to power source (24 V) circuit is in contact with power source (24 V) circuit. Short circuit Independent wiring harnesses are in contact with each other abnormally.
	3		<Precautions for troubleshooting> <p>(1) Method of indicating connector No. and handling of T-adapter Insert or connect T-adapter as explained below for troubleshooting, unless otherwise specified.</p> <ul style="list-style-type: none"> If connector No. has no marks of “male” and “female”, disconnect connector and insert T-adapters in both male side and female side. If connector No. has marks of “male” and “female”, disconnect connector and connect T-adapter to only male side or female side.
	4		<p>(2) Entry order of pin Nos. and handling of tester leads Connect positive (+) lead and negative (–) lead of tester as explained below for troubleshooting, unless otherwise specified.</p> <ul style="list-style-type: none"> Connect positive (+) lead to pin No. or wiring harness entered on front side. Connect negative (–) lead to pin No. or harness entered on rear side.

Related circuit diagram

This drawing is a part of the electric circuit diagram related to trouble-shooting.

- Connector No.: Indicates (Model – Number of pins) and (Colour).
- “Connector No. and pin No.” from each branching/merging point: Shows the ends of branch or source of merging within the parts of the same wiring harness.
- Arrow (\leftrightarrow): Roughly shows the location on the machine.

Possible problems and troubleshooting No.

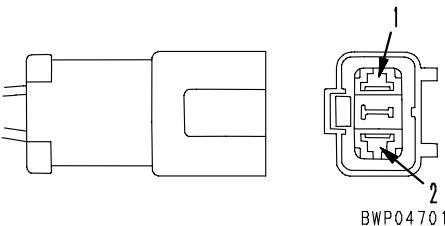
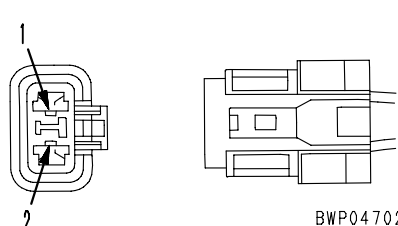
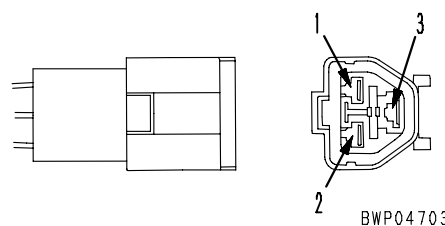
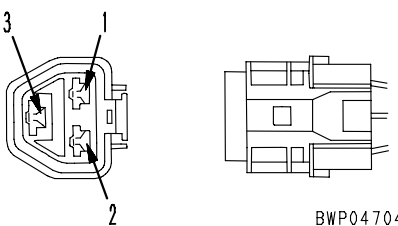
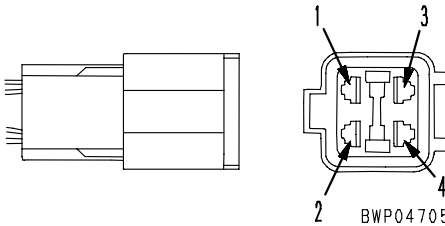
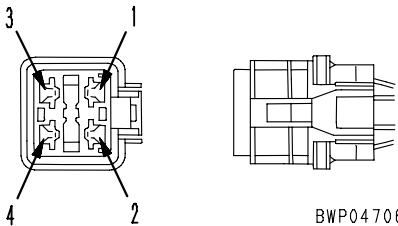
No.	Phenomena looking like troubles		Troubleshooting			
			Display of code	E-mode	H-mode	S-mode
Phenomena related to user code/failure code						
1	A user code is displayed on machine monitor.		According to displayed code			
2	When abnormality record is checked, failure code is displayed in electrical system abnormality record					
3	When abnormality record is checked, failure code is displayed in mechanical system abnormality record					
Phenomena related to engine						
4	Starting performance is poor (it always starts up slowly)					S-1
5	Engine does not start	Engine does not rotate		E-1		S-2 a)
6		Engine rotates, but exhaust gas does not come out				S-2 b)
7		Engine emits exhaust gas, but it does not start				S-2 c)
8	Engine does not pick up smoothly (follow-up performance is poor)					S-3
9	Engine stops during operations					S-4
10	Engine rotation is unstable (it hunts).					S-5
11	Engine lacks output or power					S-6
12	Exhaust smoke is black (incomplete combustion)					S-7
13	Oil consumption is excessive or exhaust smoke is blue					S-8
14	Oil becomes contaminated quickly					S-9
15	Fuel consumption is excessive					S-10
16	Oil is in coolant, coolant spurts back or coolant level goes down					S-11
17	Oil pressure drops					S-12
18	Oil level rises (Entry of coolant or fuel)					S-13
19	Coolant temperature becomes too high (overheating)					S-14
20	Abnormal noise is made					S-15
21	Vibration is excessive					S-16
22	Auto-decelerator does not operate			E-2	H-5	
23	Automatic warm-up system does not operate			E-3		
24	Preheater does not operate			E-4		
Phenomena related to work equipment, swing, and travel						
25	Speed or power of whole work equipment, swing and travel is low				H-1	S-6
26	Engine speed lowers extremely or engine stalls				H-2	S-4
27	Work equipment, swing, travel mechanism do not move			E-5	H-3	
28	Abnormal sound comes out from around hydraulic pump				H-4	
29	Fine control performance or response is low				H-6	
Phenomena related to work equipment						
30	Speed or power of boom is low			E-17,18	H-7	
31	Speed or power of arm is low			E-19,20	H-8	
32	Speed or power of bucket is low			E-21,22	H-9	
33	Work equipment does not move singly				H-10	
34	Hydraulic drift of work equipment is large				H-11	
35	Time lag of work equipment is large				H-12	
36	When part of work equipment is relieved singly, other parts of work equipment move				H-13	

No.	Phenomena looking like troubles	Troubleshooting			
		Display of code	E-mode	H-mode	S-mode
37	Power maximizing function does not work.	E-6, 17 – 22		H-14	
Phenomena related to compound operation					
38	In compound operation of work equipment, speed of part loaded more is low			H-15	
39	When machine swings and raises boom simultaneously, boom rising speed is low			H-16	
40	When machine swings and travels simultaneously, travel speed lowers largely			H-17	
Phenomena related to travel					
41	Machine deviates during travel			H-18	
42	Travel speed is low		E-25	H-19	
43	Machine is not steered well or steering power is low		E-25,26	H-20	
44	Travel speed does not change or travel speed is low or high		E-25	H-21	
45	Travel system does not move (only one side)			H-22	
Phenomena related to swing					
46	Upper structure does not swing		E-23, 24	H-23	
47	Swing acceleration or swing speed is low			H-24	
48	Upper structure overruns remarkably when it stops swinging			H-25	
49	Large shock is made when upper structure stops swinging			H-26	
50	Large sound is made when upper structure stops swinging			H-27	
51	Hydraulic drift of swing is large			H-28	
Phenomena related to machine monitor (Operator menu: ordinary screen)					
52	Machine monitor does not display any items		E-8		
53	Machine monitor does not display some items		E-9		
54	Contents of display by machine monitor are different from applicable machine		E-9		
55	Radiator coolant level monitor lights up in red during check before starting	B@BCZK			
56	Engine oil level monitor lights up in red during check before starting	B@BAZK			
57	Maintenance interval monitor lights up in red during check before starting	See the Operation and Maintenance Manual.			
58	Charge level monitor lights up in red while engine is running	AB00KE			
59	Fuel level monitor lights up in red while engine is running		E-13		
60	Air cleaner clogging monitor lights up in red while engine is running	AA10NX			
61	Engine coolant temperature monitor lights up in red while engine is running	B@BCNS			S-14
62	Hydraulic oil temperature monitor lights up in red while engine is running	B@HANS			
63	Engine coolant temperature gauge does not indicate normally		E-11		
64	Hydraulic oil temperature gauge does not indicate normally		E-12		
65	Fuel level gauge does not indicate normally		E-13		
66	Swing lock monitor does not indicate normally		E-14		
67	Machine monitor display anything even when operated on monitor switch section		E-15		
68	Windshield wiper and window washer do not operate		E-16		

No.	Phenomena looking like troubles	Troubleshooting			
		Display of code	E-mode	H-mode	S-mode
Phenomena related to machine monitor (Service menu: special functions screen)					
69	Monitoring function does not display “Boom RAISE” normally		E-17		
70	Monitoring function does not display “Boom LOWER” normally		E-18		
71	Monitoring function does not display “Arm IN” normally		E-19		
72	Monitoring function does not display “Arm OUT” normally		E-20		
73	Monitoring function does not display “Bucket CURL” normally		E-21		
74	Monitoring function does not display “Bucket DUMP” normally		E-22		
75	Monitoring function does not display “Swing” normally		E-23		
76	Monitoring function does not display “Swing RIGHT” normally		E-24		
77	Monitoring function does not display “Travel LEFT” normally		E-25		
78	Monitoring function does not display “Travel Steering” normally		E-26		
79	Monitoring function does not display “Service” normally		E-27		
Phenomena related to KOMTRAX					
80	KOMTRAX system does not operate normally		E-28		
Other phenomena					
81	Air conditioner does not operate		E-29		
82	Travel alarm does not sound or does not stop sounding		E-30		
83	Horn does not sound		E-31		

Wiring table for connector pin numbers

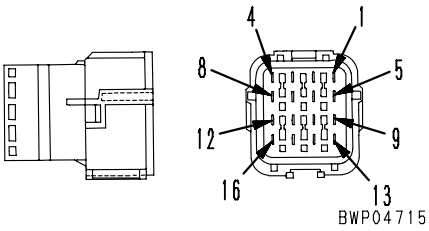
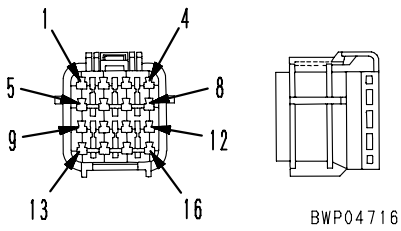
★ The terms of male and female refer to the pins, while the terms of male housing and female housing refer to the mating portion of the housing.

No. of pins	X type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
1	Part No. : 08055-00181	Part No. : 08055-00191	799-601-7010
2	 BWP04701	 BWP04702	799-601-7020
	Part No. : 08055-00282	Part No. : 08055-00292	
3	 BWP04703	 BWP04704	799-601-7030
	Part No. : 08055-00381	Part No. : 08055-00391	
4	 BWP04705	 BWP04706	799-601-7040
	Part No. : 08055-00481	Part No. : 08055-00491	
—	Terminal part No. : 79A-222-3370 ·Electric wire size: 0.85 ·Grommet:Black ·Q'ty: 20	Terminal part No. : 79A-222-3390 ·Electric wire size: 0.85 ·Grommet:Black ·Q'ty: 20	—
—	Terminal part No. : 79A-222-3380 ·Electric wire size: 2.0 ·Grommet:Red ·Q'ty: 20	Terminal part No. : 79A-222-3410 ·Electric wire size: 2.0 ·Grommet:Red ·Q'ty: 20	—

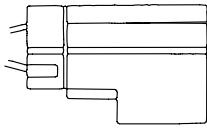
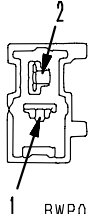

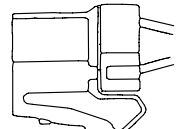
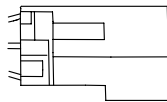
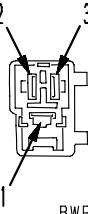

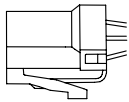
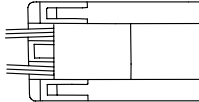
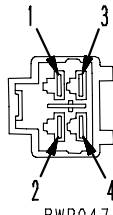
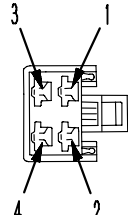

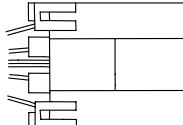
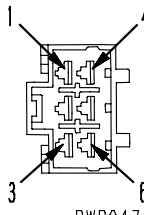
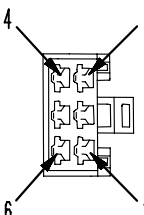
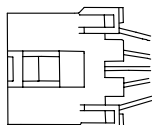
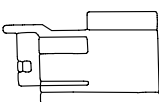
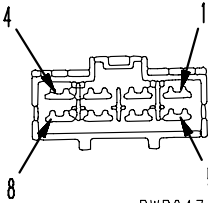
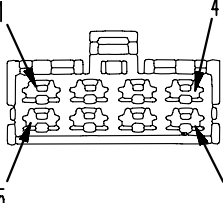
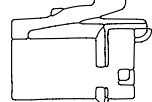
9JS04890

No. of pins	SWP type connector		
	Male (female housing)	Female (male housing)	T-adaptor Part No.
6	 BWP04707	 BWP04708	799-601-7050
	Part No. : 08055-10681	Part No. : 08055-10691	
8	 BWP04709	 BWP04710	799-601-7060
	Part No. : 08055-10881	Part No. : 08055-10891	
12	 BWP04711	 BWP04712	799-601-7310
	Part No. : 08055-11281	Part No. : 08055-11291	
14	 BWP04713	 BWP04714	799-601-7070
	Part No. : 08055-11481	Part No. : 08055-11491	

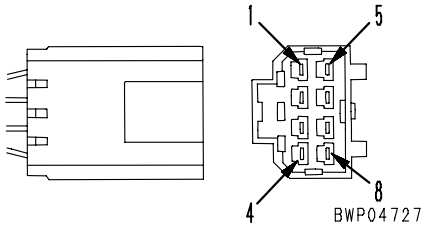
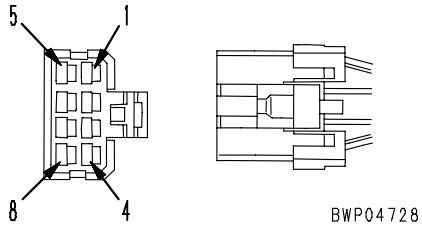
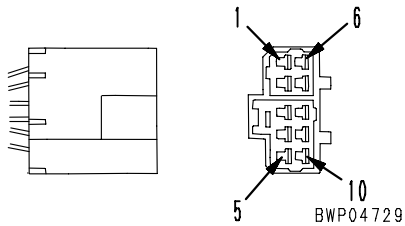
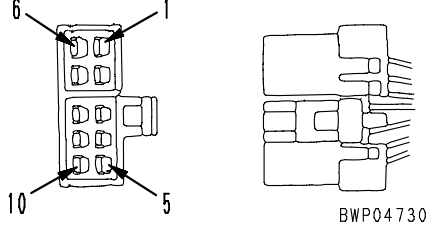
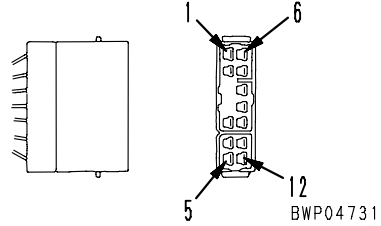
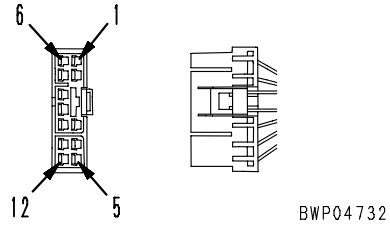
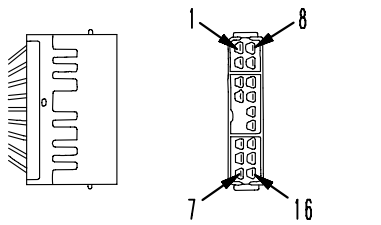
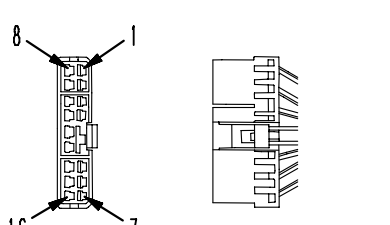
9JS04891

No. of pins	SWP type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
16	 <p>BWP04715</p>	 <p>BWP04716</p>	799-601-7320
	Part No. : 08055-11681	Part No. : 08055-11691	
—	Terminal part No. : ·Electric wire size: 0.85 ·Grommet:Black ·Q'ty: 20	Terminal part No. : ·Electric wire size: 0.85 ·Grommet:Black ·Q'ty: 20	—
—	Terminal part No. : ·Electric wire size: 1.25 ·Grommet:Red ·Q'ty: 20	Terminal part No. : ·Electric wire size: 1.25 ·Grommet:Red ·Q'ty: 20	—

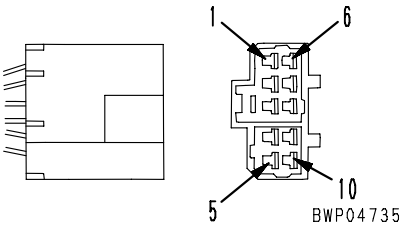
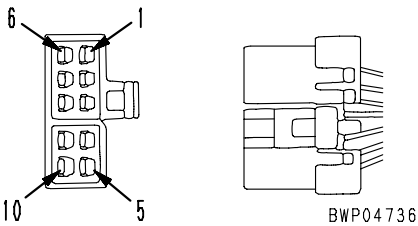
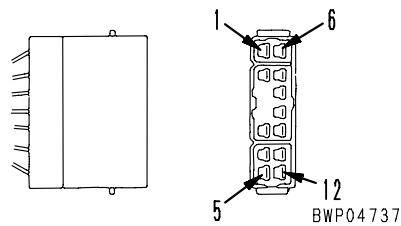
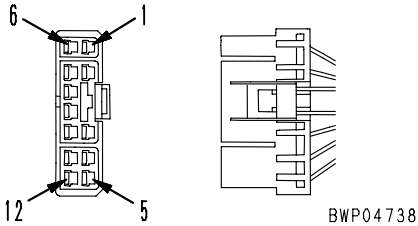
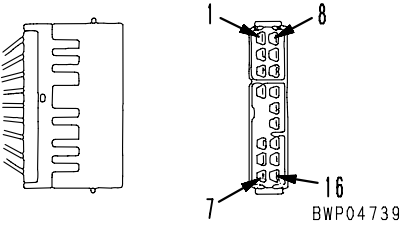
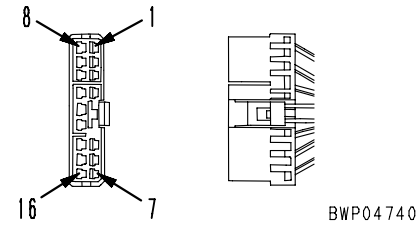
9JS04892

No. of pins	M type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
1	Part No. : 08056-00171	Part No. : 08056-00181	799-601-7080
2	  BWP04717	  BWP04718	799-601-7090
	Part No. : 08056-00271	Part No. : 08056-00281	
3	  BWP04719	  BWP04720	799-601-7110
	Part No. : 08056-00371	Part No. : 08056-00381	
4	  BWP04721	  BWP04722	799-601-7120
	Part No. : 08056-00471	Part No. : 08056-00481	
6	  BWP04723	  BWP04724	799-601-7130
	Part No. : 08056-00671	Part No. : 08056-00681	
8	  BWP04725	  BWP04726	799-601-7340
	Part No. : 08056-00871	Part No. : 08056-00881	

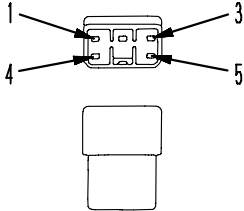
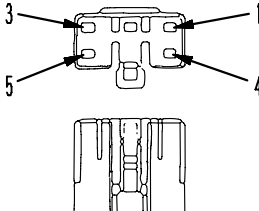
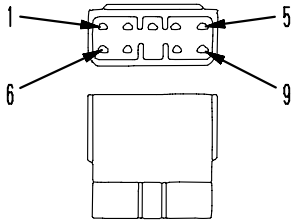
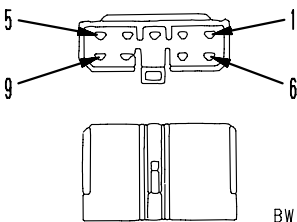
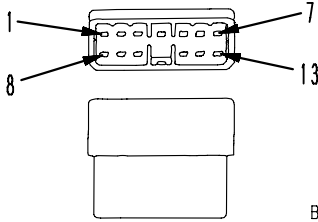
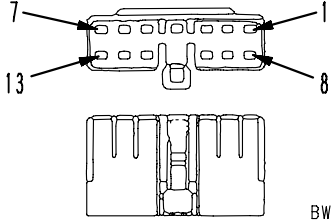
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No. of pins	S type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
8	 BWP04727	 BWP04728	799-601-7140
	Part No. : 08056-10871	Part No. : 08056-10881	
10 (White)	 BWP04729	 BWP04730	799-601-7150
	Part No. : 08056-11071	Part No. : 08056-11081	
12 (White)	 BWP04731	 BWP04732	799-601-7350
	Part No. : 08056-11271	Part No. : 08056-11281	
16 (White)	 BWP04733	 BWP04734	799-601-7330
	Part No. : 08056-11671	Part No. : 08056-11681	

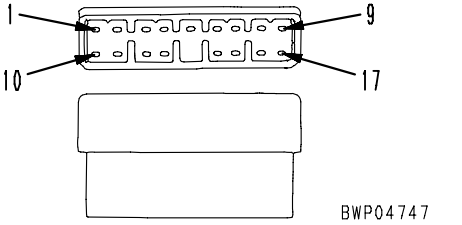
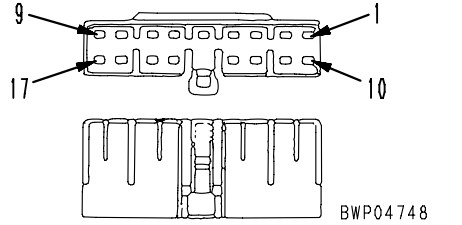
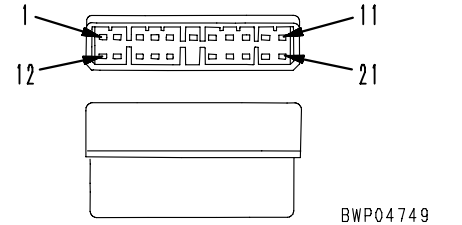
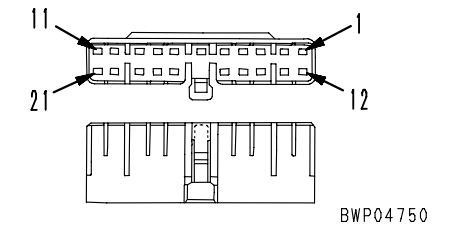
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No. of pins	S type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
10 (Blue)			—
	—	—	
12 (Blue)			799-601-7160
	Part No. : 08056-11272	Part No. : 08056-11282	
16 (Blue)			799-601-7170
	Part No. : 08056-11672	Part No. : 08056-11682	

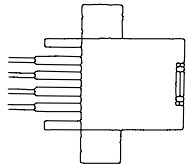
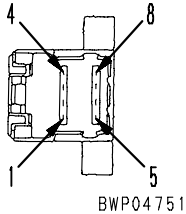
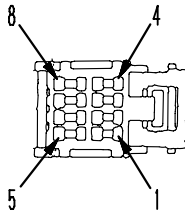
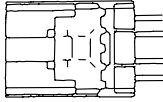
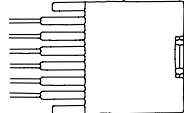
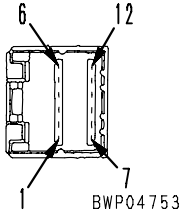
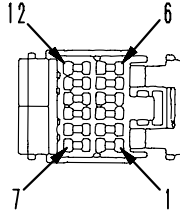
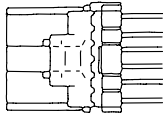
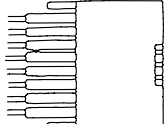
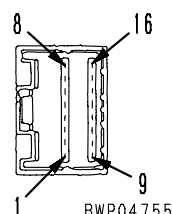
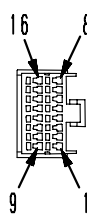

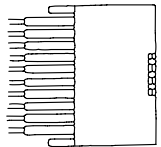
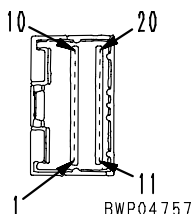
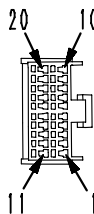
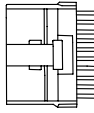
9JS04895

No. of pins	MIC type connector		
	Male (female housing)	Female (male housing)	T-adaptor Part No.
7	Body part No. : 79A-222-2640 (Q' ty:5)	Body part No. : 79A-222-2630 (Q' ty:5)	—
11	Body part No. : 79A-222-2680 (Q' ty:5)	Body part No. : 79A-222-2670 (Q' ty:5)	—
5	 BWP04741	 BWP04742	799-601-2710
	Body part No. : 79A-222-2620 (Q' ty:5)	Body part No. : 79A-222-2610 (Q' ty:5)	
9	 BWP04743	 BWP04744	799-601-2950
	Body part No. : 79A-222-2660 (Q' ty:5)	Body part No. : 79A-222-2650 (Q' ty:5)	
13	 BWP04745	 BWP04746	799-601-2720
	Body part No. : 79A-222-2710 (Q' ty:2)	Body part No. : 79A-222-2690 (Q' ty:2)	

9JS04896

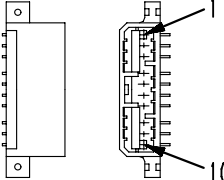
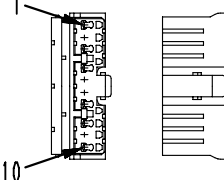
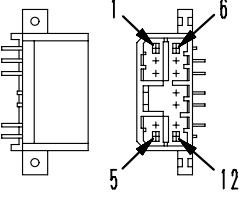
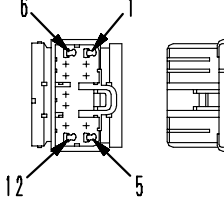
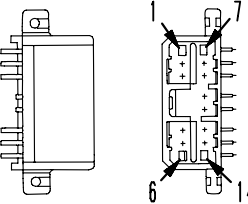
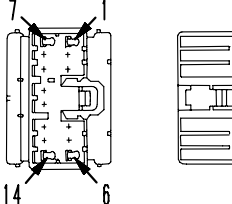
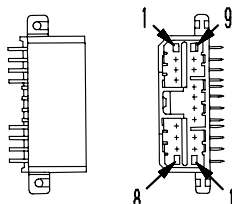
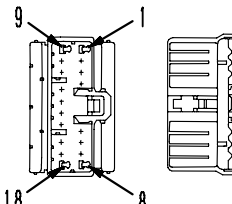
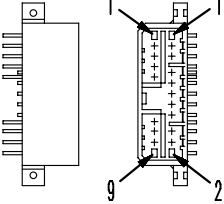
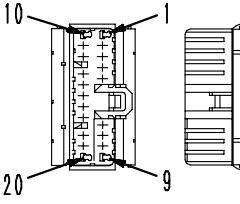
No. of pins	MIC type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
17	 BWP04747	 BWP04748	799-601-2730
	Body part No. : 79A-222-2730 (Q' ty:2)	Body part No. : 79A-222-2720 (Q' ty:2)	
21	 BWP04749	 BWP04750	799-601-2740
	Body part No. : 79A-222-2750 (Q' ty:2)	Body part No. : 79A-222-2740 (Q' ty:2)	
	Terminal part No. : 79A-222-2770 (Q' ty:50)	Terminal part No. : 79A-222-2760 (Q' ty:50)	

9JS04897

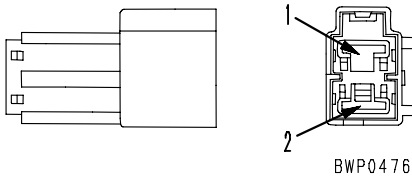
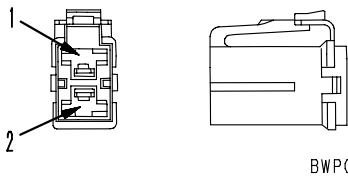
No. of pins	AMP040 type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
8	  BWP04751	  BWP04752	799-601-7180
	—	Housing part No. : 79A-222-3430 (Q' ty:5)	
12	  BWP04753	  BWP04754	799-601-7190
	—	Housing part No. : 79A-222-3440 (Q' ty:5)	
16	  BWP04755	  BWP04756	799-601-7210
	—	Housing part No. : 79A-222-3450 (Q' ty:5)	
20	  BWP04757	  BWP04758	799-601-7220
	—	Housing part No. : 79A-222-3460 (Q' ty:5)	
★ Terminal part No. : 79A-222-3470 (No relation with number of pins)			

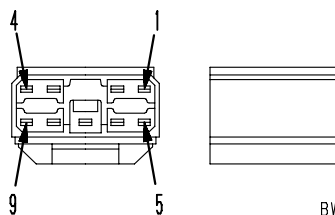
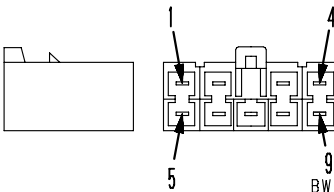
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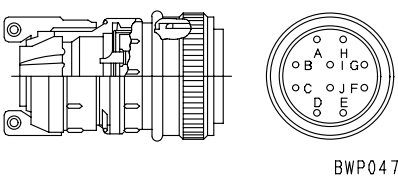
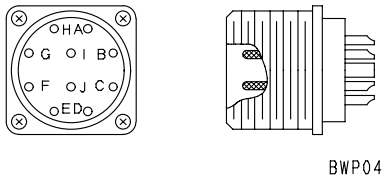
9JS04898

No. of pins	AMP070 type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
10	 BWP04759	 BWP04760	799-601-7510
	—	Part No. : 7821-92-7330	
12	 BWP04761	 BWP04762	799-601-7520
	—	Part No. : 7821-92-7340	
14	 BWP04763	 BWP04764	799-601-7530
	—	Part No. : 7821-92-7350	
18	 BWP04765	 BWP04766	799-601-7540
	—	Part No. : 7821-92-7360	
20	 BWP04767	 BWP04768	799-601-7550
	—	Part No. : 7821-92-7370	

9JS04899

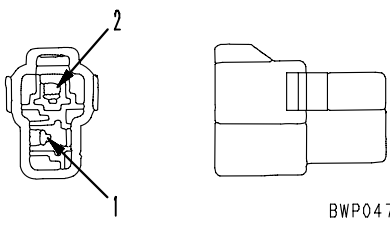
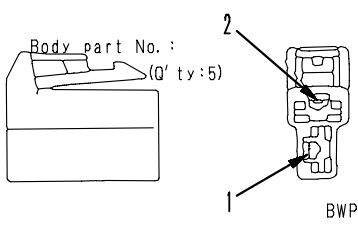
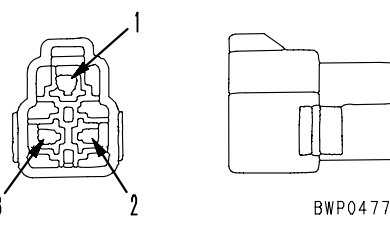
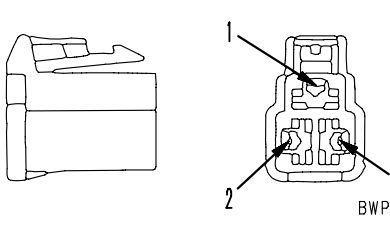
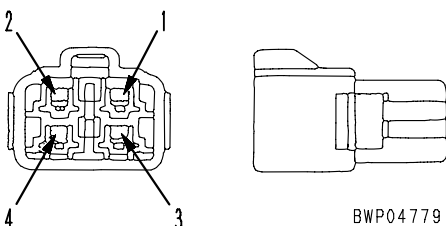
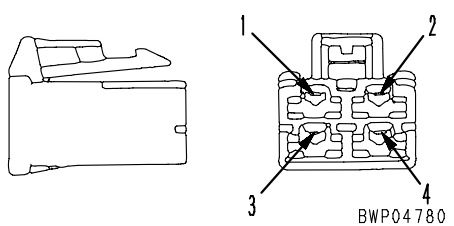
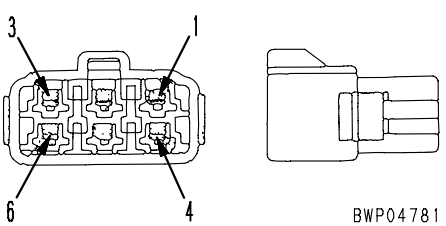
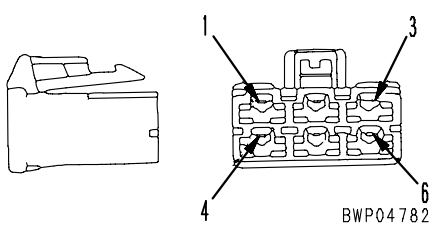
L type connector			
No. of pins	Male (female housing)	Female (male housing)	T-adapter Part No.
2	 BWP04769	 BWP04770	—
	—	—	

Connector for PA			
No. of pins	Male (female housing)	Female (male housing)	T-adapter Part No.
9	 BWP04771	 BWP04772	—
	—	—	

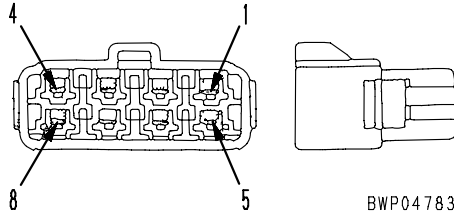
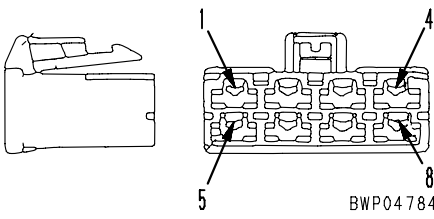
Bendix MS connector			
No. of pins	Male (female housing)	Female (male housing)	T-adapter Part No.
10	 BWP04773	 BWP04774	799-601-3460
	—	—	

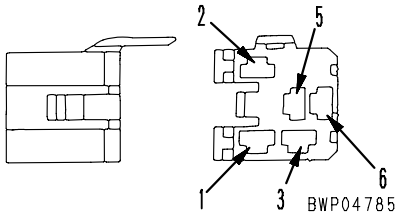
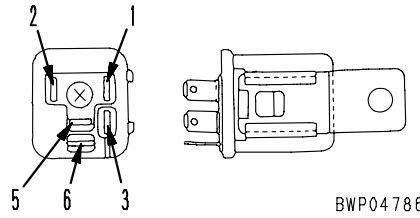
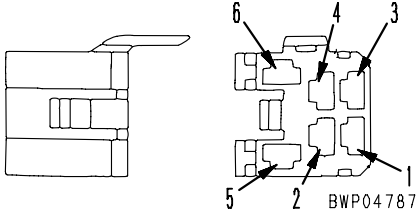
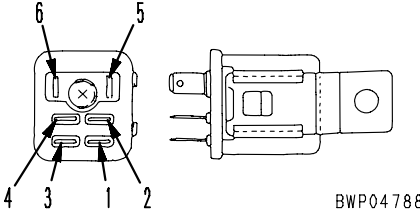
9JS04900

9JS04900

No. of pins	KES 1 (Automobile) connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
2	 <p>BWP04775</p>	 <p>Body part No. : (Qty:5) BWP04776</p>	—
	Part No. : 08027-10210 (Natural color) 08027-10220 (Black)	Part No. : 08027-10260 (Natural color) 08027-10270 (Black)	
3	 <p>BWP04777</p>	 <p>BWP04778</p>	—
	Part No. : 08027-10310	Part No. : 08027-10360	
4	 <p>BWP04779</p>	 <p>BWP04780</p>	—
	Part No. : 08027-10410 (Natural color) 08027-10420 (Black)	Part No. : 08027-10460 (Natural color) 08027-10470 (Black)	
6	 <p>BWP04781</p>	 <p>BWP04782</p>	—
	Part No. : 08027-10610 (Natural color) 08027-10620 (Black)	Part No. : 08027-10660 (Natural color) 08027-10670 (Black)	

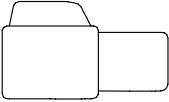
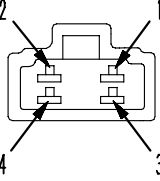
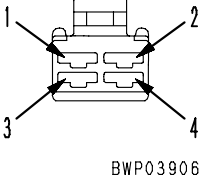
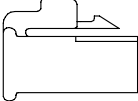
9JS04901

No. of pins	KES1 (Automobile) connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
8	 <p>BWP04783</p>	 <p>BWP04784</p>	—
	Part No. :08027-10810 (Natural color) 08027-10820 (Black)	Part No. :08027-10860 (Natural color) 08027-10870 (Black)	

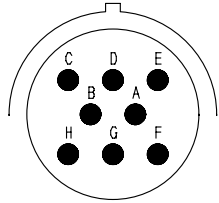
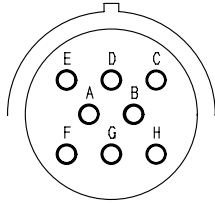
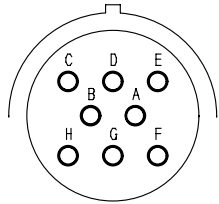
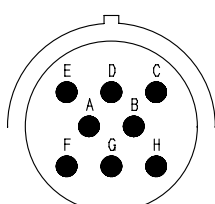
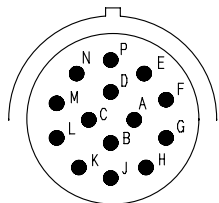
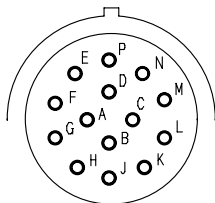
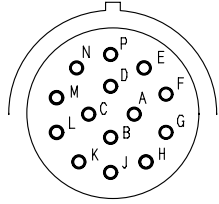
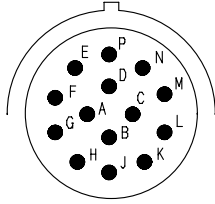
No. of pins	Connector for relay (Socket type)		
	Male (female housing)	Female (male housing)	T-adapter Part No.
5	 <p>BWP04785</p>	 <p>BWP04786</p>	799-601-7360
	—	—	
6	 <p>BWP04787</p>	 <p>BWP04788</p>	799-601-7370
	—	—	

9JS04902

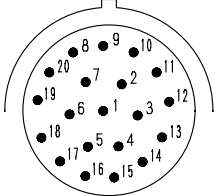
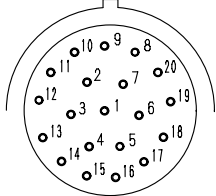
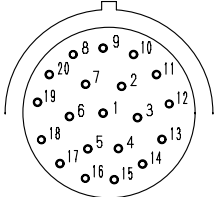
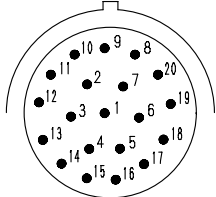
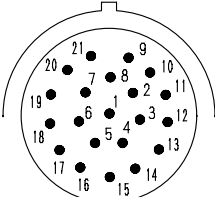
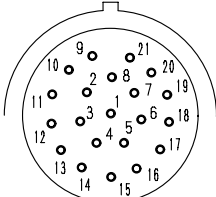
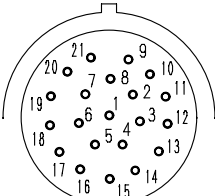
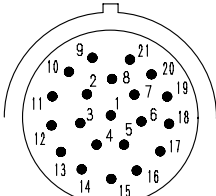
9JS04902

No. of pins	F type connector		
	Male (female housing)	Female (male housing)	T-adapter Part No.
4	<div><p>BWP03905</p></div>	<div><p>BWP03906</p></div>	—
	—	—	

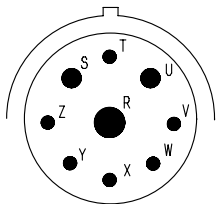
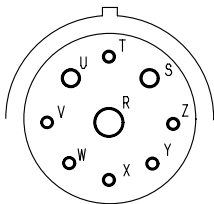
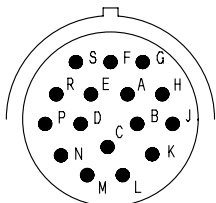
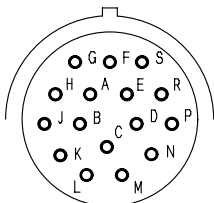
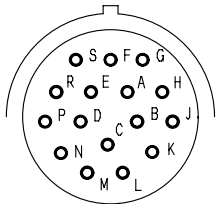
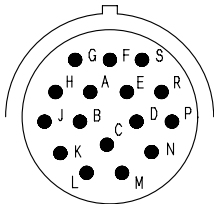
9JS04903

[The pin No. is also marked on the connector (electric wire insertion end)]			
Type (shell size code)	HD30 Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
18-8 (1)	Pin (male terminal)	Socket (female terminal)	799-601-9210
	 BWP05001	 BWP05002	
	Part No. : 08191-11201, 08191-11202, 08191-11205, 08191-11206	Part No. : 08191-14101, 08191-14102, 08191-14105, 08191-14106	799-601-9210
	Socket (female terminal)	Pin (male terminal)	
18-14 (2)	 BWP05003	 BWP05004	799-601-9220
	Part No. : 08191-12201, 08191-12202, 08191-12205, 08191-12206	Part No. : 08191-13101, 08191-13102, 08191-13105, 08191-13106	
	Pin (male terminal)	Socket (female terminal)	799-601-9220
	 BWP05005	 BWP05006	
18-14 (2)	Part No. : 08191-21201, 08191-21202, 08191-21205, 08191-21206	Part No. : 08191-24101, 08191-24102, 08191-24105, 08191-24106	799-601-9220
	Socket (female terminal)	Pin (male terminal)	
	 BWP05007	 BWP05008	799-601-9220
	Part No. : 08191-22201, 08191-22202, 08191-22205, 08191-22206	Part No. : 08191-23101, 08191-23102, 08191-23105, 08191-23106	

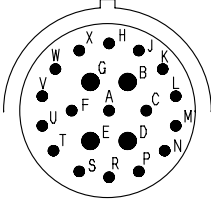
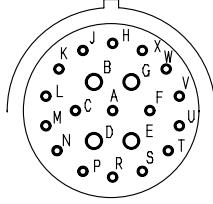
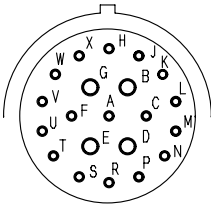
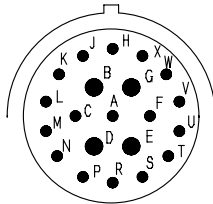
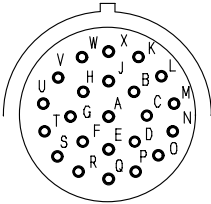
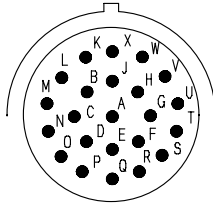
9JS04904

[The pin No. is also marked on the connector (electric wire insertion end)]			
Type (shell size code)	HD30 Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
18-20 (3)	Pin (male terminal)	Socket (female terminal)	799-601-9230
	 BWP05009	 BWP05010	
	Part No. :08191-31201, 08191-31202	Part No. :08191-34101, 08191-34102	799-601-9230
	Socket (female terminal)	Pin (male terminal)	
18-21 (4)	 BWP05011	 BWP05012	799-601-9240
	Part No. :08191-32201, 08191-32202	Part No. :08191-33101, 08191-33102	
	Pin (male terminal)	Socket (female terminal)	799-601-9240
	 BWP05013	 BWP05014	
18-21 (4)	Part No. :08191-41201, 08191-42202	Part No. :08191-44101, 08191-44102	799-601-9240
	Socket (female terminal)	Pin (male terminal)	
	 BWP05015	 BWP05016	799-601-9240
	Part No. :08191-42201, 08191-42202	Part No. :08191-43101, 08191-43102	

9JS04905

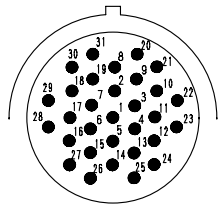
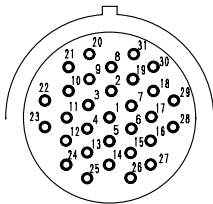
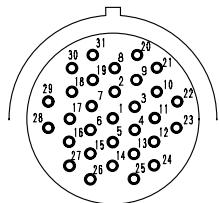
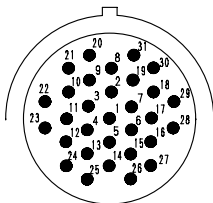
[The pin No. is also marked on the connector (electric wire insertion end)]			
Type (shell size code)	HD30 Series connector		
	Body (plug)	Body (receptacle)	T-adaptor Part No.
24-9 (5)	Pin (male terminal)	Socket (female terminal)	799-601-9250
	 BWP05017	 BWP05018	
	Part No. : 08191-51201, 08191-51202	Part No. : 08191-54101, 08191-54102	799-601-9250
	Socket (female terminal)	Pin (male terminal)	
24-16 (6)	 BWP05021	 BWP05022	799-601-9260
	Part No. : 08191-61201, 08191-62202, 08191-61205, 08191-62206	Part No. : 08191-64101, 08191-64102, 08191-64105, 08191-64106	
	Socket (female terminal)	Pin (male terminal)	799-601-9260
	 BWP05023	 BWP05024	
	Part No. : 08191-62201, 08191-62202, 08191-62205, 08191-62206	Part No. : 08191-63101, 08191-63102, 08191-63105, 08191-63106	

9JS04906

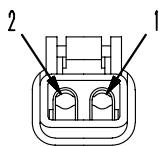
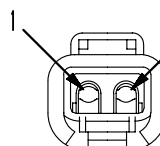
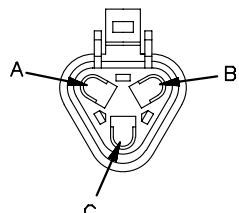
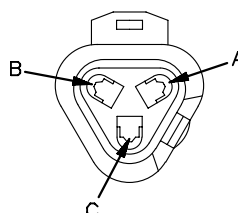
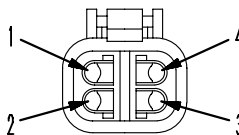
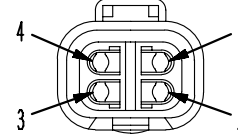
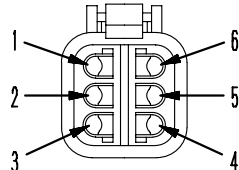
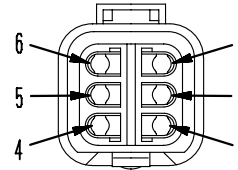
[The pin No. is also marked on the connector (electric wire insertion end)]			
Type (shell size code)	HD30 Series connector		
	Body (plug)	Body (receptacle)	T-adaptor Part No.
24-21 (7)	Pin (male terminal)	Socket (female terminal)	799-601-9270
	 BWP05025	 BWP05026	
	Part No. :08191-71201, 08191-71202, 08191-71205, 08191-71206	Part No. :08191-74101, 08191-74102, 08191-74105, 08191-74106	799-601-9270
	Socket (female terminal)	Pin (male terminal)	
24-23 (8)	 BWP05029	 BWP05030	799-601-9280
	Part No. :08191-81201, 08191-81202, 08191-81203, 08191-81204, 08191-81205, 08191-80206	Part No. :08191-84101, 08191-84102, 08191-84103, 08191-84104, 08191-84105, 08191-84106	
	Socket (female terminal)	Pin (male terminal)	799-601-9280
	 BWP05031	 BWP05032	
	Part No. :08191-82201, 08191-82202, 08191-82203, 08191-82204, 08191-82205, 08191-82206	Part No. :08191-83101, 08191-83102, 08191-83103, 08191-83104, 08191-83105, 08191-83106	

9JS04907

[The pin No. is also marked on the connector (electric wire insertion end)]

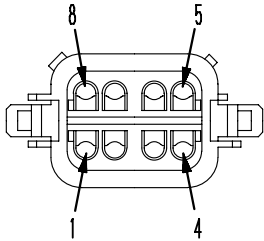
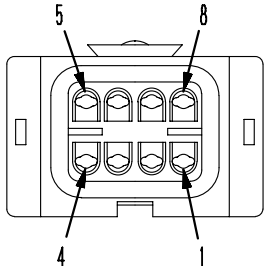
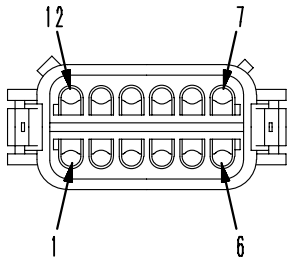
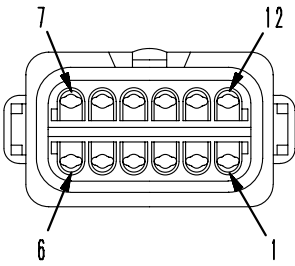
Type (shell size code)	HD30 Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
24-31 (9)	Pin (male terminal)	Socket (female terminal)	799-601-9290
	 BWP05033	 BWP05034	
	Part No. : 08191-91203, 08191-91204, 08191-91205, 08191-91206	Part No. : 08191-94103, 08191-94104, 08191-94105, 08191-94106	799-601-9290
	Socket (female terminal)	Pin (male terminal)	
	 BWP05035	 BWP05036	
	Part No. : 08191-92203, 08191-92204, 08191-92205, 08191-92206	Part No. : 08191-93103, 08191-93104, 08191-93105, 08191-93106	

9JS04908

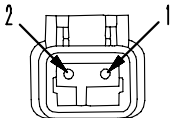
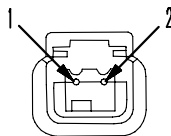
[The pin No. is also marked on the connector (electric wire insertion end)]			
No. of pins	DT Series connector		
	Body (plug)	Body (receptacle)	T-adaptor Part No.
2	 <p>BWP05037</p>	 <p>BWP05038</p>	799-601-9020
	Part No. :08192-12200 (normal type) 08192-22200 (fine wire type)	Part No. :08192-12100 (normal type) 08192-22100 (fine wire type)	
3	 <p>BWP05039</p>	 <p>BWP05040</p>	799-601-9030
	Part No. :08192-1A200 (normal type) 08192-2A200 (fine wire type)	Part No. :08192-13100 (normal type) 08192-23100 (fine wire type)	
4	 <p>BWP05041</p>	 <p>BWP05042</p>	799-601-9040
	Part No. :08192-14200 (normal type) 08192-24200 (fine wire type)	Part No. :08192-14100 (normal type) 08192-24100 (fine wire type)	
6	 <p>BWP05043</p>	 <p>BWP05044</p>	799-601-9050
	Part No. :08192-16200 (normal type) 08192-26200 (fine wire type)	Part No. :08192-16100 (normal type) 08192-26100 (fine wire type)	

BJD14069

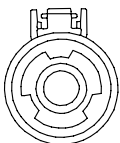
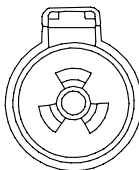
[The pin No. is also marked on the connector (electric wire insertion end)]

No. of pins	DT Series connector		
	Body (plug)	Body (receptacle)	T-adaptor Part No.
8	 <p>BWP05045</p>	 <p>BWP05046</p>	8GR: 799-601-9060 8B: 799-601-9070 8G: 799-601-9080 8BR: 799-601-9090
	Part No. : 08192-1820□ (normal type) 08192-2820□ (fine wire type)	Part No. : 08192-1810□ (normal type) 08192-2810□ (fine wire type)	
12	 <p>BWP05047</p>	 <p>BWP05048</p>	12GR: 799-601-9110 12B: 799-601-9120 12G: 799-601-9130 12BR: 799-601-9140
	Part No. : 08192-1920□ (normal type) 08192-2920□ (fine wire type)	Part No. : 08192-1910□ (normal type) 08192-2910□ (fine wire type)	

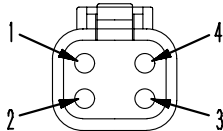
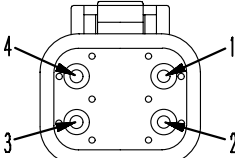
9JS04910

[The pin No. is also marked on the connector (electric wire insertion end)]			
No. of pins	DTM Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
2	 <p>BWP05049</p>	 <p>BWP05050</p>	799-601-9010
	Part No. :08192-02200	Part No. :08192-02100	

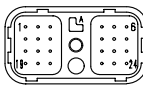
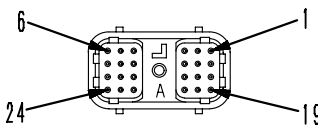
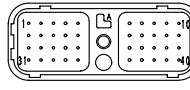
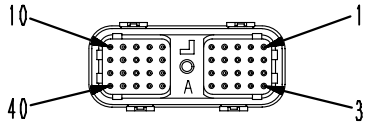
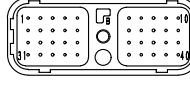
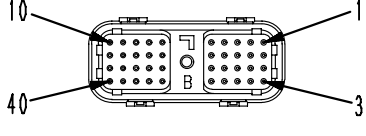
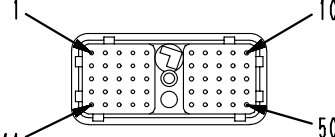
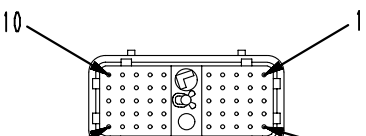
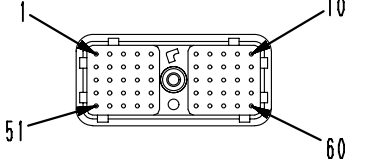
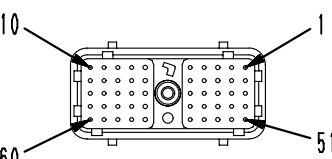
9JS04911

[The pin No. is also marked on the connector (electric wire insertion end)]			
No. of pins	DTHD Series connector		
	Body (plug)	Body (receptacle)	T-adapter Part No.
2	 <p>BWP05051</p>	 <p>BWP05052</p>	—
	Part No. :08192-31200 (Contact size #12) 08192-41200 (Contact size #8) 08192-51200 (Contact size #4)	Part No. :08192-31100 (Contact size #12) 08192-41100 (Contact size #8) 08192-51100 (Contact size #4)	

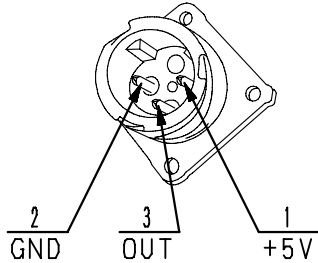
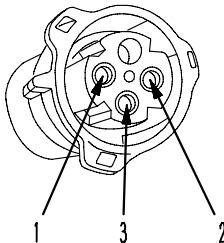
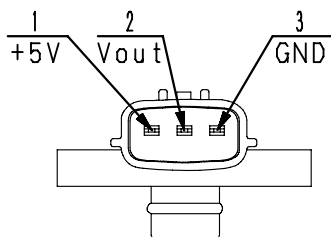
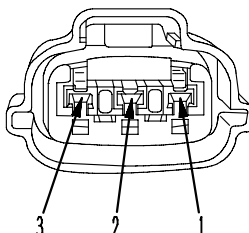
9JS04912

[The pin No. is also marked on the connector (electric wire insertion end)]			
No. of pins	DTP4 Series connector		
	Pin (male terminal)	Socket (female terminal)	T-adapter Part No.
4	 <p>BJD14066</p>	 <p>BJD14067</p>	799-601-4260
	—	Part No. :6261-81-2810	

BJD14071

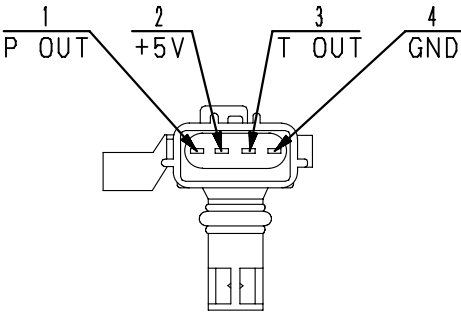
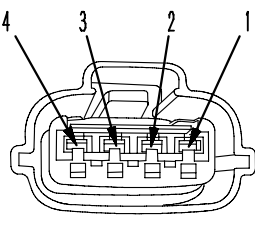
[The pin No. is also marked on the connector (electric wire insertion end)]			
No. of pins	DRC26 Series connector		
	Body (plug)	Body (receptacle)	T-adaptor Part No.
24	 BJD12722	 BJD12723	799-601-9360
	—	Part No. :08194-01101	
40 (A)	 BJD12724	 BJD12725	799-601-9350
	—	Part No. :08194-02101	
40 (B)	 BJD12726	 BJD12727	799-601-9350
	—	Part No. :08194-02102	
50	 9JS02951	 9JS02952	799-601-4210
	—	Part No. :08194-03103	
60	 BJD14063	 BJD14064	799-601-4220
	—	Part No. :08194-04104	

BJD14070

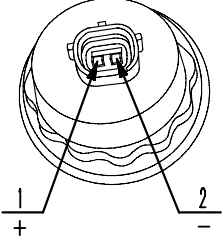
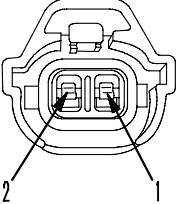
Tier III Engine			
No. of pins	Boost (air intake) pressure (140)		
	Sensor side (plug)	Harness side (receptacle)	T-adapter Part No.
4			799-601-4110
	☆ Without pin (4)	☆ Without pin (4)	
No. of pins	Boost (air intake) pressure (125, 170, 12V140)		
	Sensor side (plug)	Harness side (receptacle)	T-adapter Part No.
3			799-601-4250 (Kit: 799-601-4100)
	—	—	

BJH12940

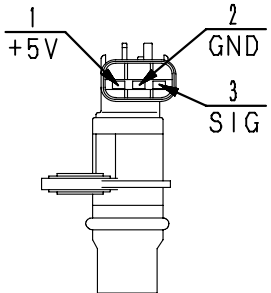
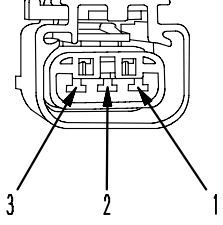
BJH12940

Tier III Engine (107, 114)			
No. of pins	Boost (air intake) pressure, temperature sensor		
	Sensor side (plug)	Harness side (receptacle)	T-adapter Part No.
4			799-601-4230 (Kit: 799-601-4100)
	—	—	

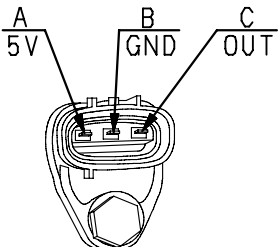
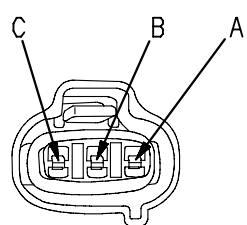
BJH12941

Tier III Engine (125, 140, 170, 12V140)			
No. of pins	PCV		
	Valve side (plug)	Harness side (receptacle)	T-adapter Part No.
2			799-601-9430 (Kit: 799-601-4100)
	—	—	

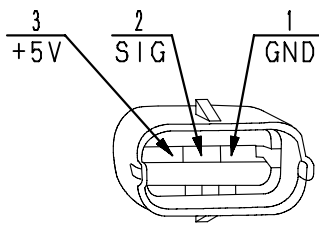
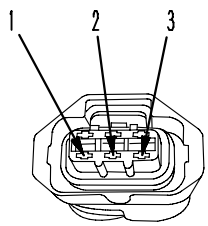
BJH12942

Tier III Engine			
No. of pins	NE speed sensor (107, 114, 125, 140, 170, 12V140), CAM sensor (107, 114)		
	Sensor side (plug)	Harness side (receptacle)	T-adapter Part No.
3			799-601-4130 (Kit: 799-601-4100)
	—	—	

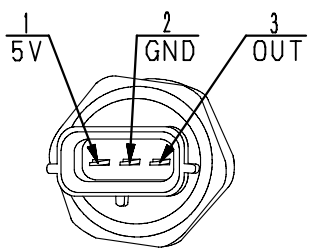
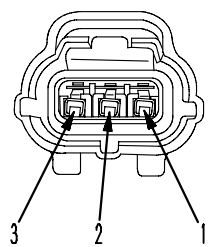
BJH12943

Tier III Engine (125, 140, 170, 12V140)			
No. of pins	G sensor (fuel supply pump speed sensor)		
	Sensor side (plug)	Harness side (receptacle)	T-adapter Part No.
3			799-601-4330 (Kit: 799-601-4100)
	—	—	

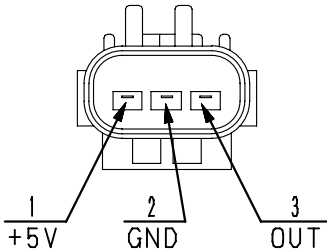
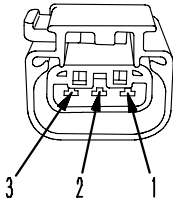
BJH12944

Tier III Engine (107, 114)			
No. of pins	Common rail (fuel) pressure		
	Sensor side (plug)	Harness side (receptacle)	T-adapter Part No.
3			799-601-4190 (Kit: 799-601-4100)
	—	—	

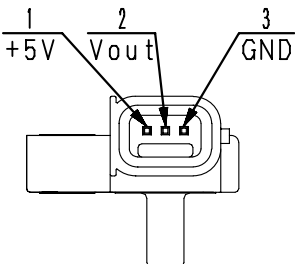
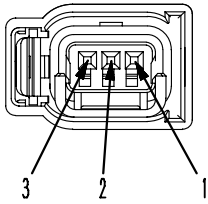
BJH12945

Tier III Engine (125, 140, 170, 12V140)			
No. of pins	Common rail (fuel) pressure		
	Sensor side (plug)	Harness side (receptacle)	T-adapter Part No.
3			799-601-9420 (Kit: 799-601-4100)
	—	—	

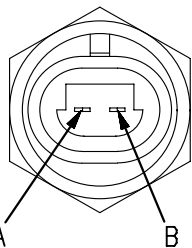
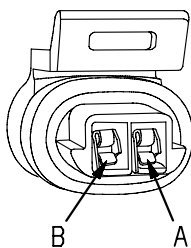
BJH12946

Tier III Engine			
No. of pins	Ambient pressure sensor (107, 114)		
	Sensor side (plug)	Harness side (receptacle)	T-adapter Part No.
3			799-601-4140 (Kit: 799-601-4100)
	—	—	

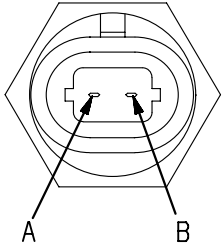
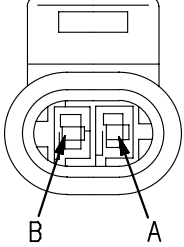
BJH12947

Tier III Engine			
No. of pins	Ambient pressure sensor (125, 140, 170, 12V140)		
	Sensor side (plug)	Harness side (receptacle)	T-adapter Part No.
3			799-601-4240 (Kit: 799-601-4100)
	—	—	

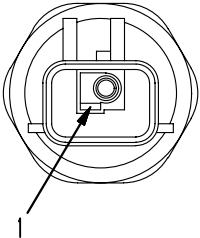
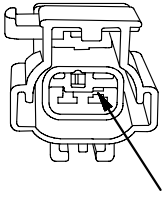
BJH12948

Tier III Engine			
No. of pins	Temperature sensor of coolant, fuel and lubricating oil (107, 114, 125, 140, 170, 12V140)		
	Sensor side (plug)	Harness side (receptacle)	T-adapter Part No.
2			795-799-5530 (Kit: 799-601-4100)
	☆ Non-polarity	—	

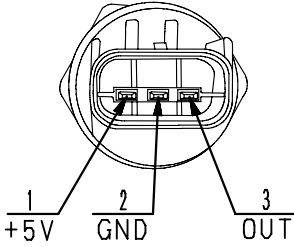
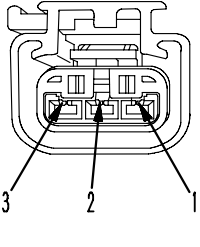
BJH12949

Tier III Engine			
No. of pins	Boost (air intake) temperature sensor (125, 140, 170, 12V140)		
	Sensor side (plug)	Harness side (receptacle)	T-adapter Part No.
2			795-799-5540 (Kit: 799-601-4100)
	☆ Non-polarity	—	

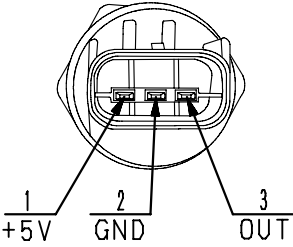
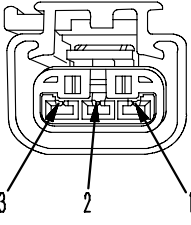
BJH12950

Tier III Engine (107, 114)			
No. of pins	Hydraulic switch		
	Switch side (plug)	Harness side (receptacle)	T-adapter Part No.
2			799-601-4160 (Kit: 799-601-4100)
	☆ Without pin (2)	☆ Without pin (2)	

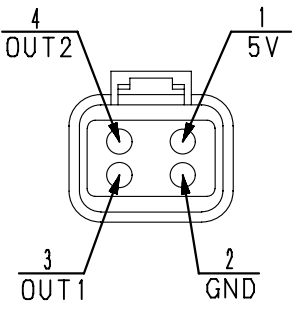
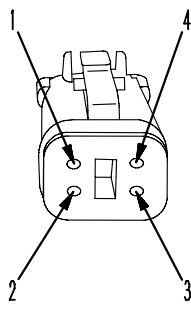
BJH12951

Tier III Engine (125, 140, 170, 12V140)			
No. of pins	Lubricating oil pressure		
	Sensor side (plug)	Harness side (receptacle)	T-adapter Part No.
			799-601-4150 (Kit: 799-601-4100)
	—	—	

BJH12952

Tier III Engine (125, 140)			
No. of pins	EGR gas pressure sensor		
	Sensor side (plug)	Harness side (receptacle)	T-adapter Part No.
			799-601-4180 (Kit: 799-601-4100)
	—	—	

BJH12953

Tier III Engine (125, 140, 170, 12V140)			
No. of pins	EGR (by pass) valve stroke sensor		
	Sensor side (plug)	Harness side (receptacle)	T-adapter Part No.
4			799-601-9040 (Kit: 799-601-4100)
	—	—	

BJH12954

T-adapter box and T-adapter table

★ The vertical column shows part number of T-Branch Box or T-Branch, and horizontal column shows part number of T-Branch.

Part No.	Part name	No. of pins	Identification code	T-adapter kit																	out of kit	
				799-601-2500	799-601-2700	799-601-2800	799-601-2900	799-601-3000	799-601-5500	799-601-6000	799-601-6500	799-601-7000	799-601-7100	799-601-7400	799-601-7500	799-601-8000	799-601-9000	799-601-9100	799-601-9200	799-601-9300		
799-601-2600	T-adapter box (for ECONO)	21		●		●	●							●	●		●					
799-601-3100	T-adapter box (for MS)	37						●														
799-601-3200	T-adapter box (for MS)	37						●														
799-601-3300	T-adapter box (for ECONO)	24								●												
799-601-3360	• Plate for MS (24 pins)									●												
799-601-3370	• Plate for MS (17 pins)									●												
799-601-3380	• Plate for MS (14 pins)									●												
799-601-3410	Adapter for BENDIX (MS)	24	MS-24P							●	●											
799-601-3420	Adapter for BENDIX (MS)	24	MS-24P							●	●											
799-601-3430	Adapter for BENDIX (MS)	17	MS-17P							●	●											
799-601-3440	Adapter for BENDIX (MS)	17	MS-17P							●	●											
799-601-3450	Adapter for BENDIX (MS)	5	MS-5P						●	●												
799-601-3460	Adapter for BENDIX (MS)	10	MS-10P							●	●											
799-601-3510	Adapter for BENDIX (MS)	5	MS-5S						●	●												
799-601-3520	Adapter for BENDIX (MS)	17	MS-17P						●	●												
799-601-3530	Adapter for BENDIX (MS)	19	MS-19P							●	●											
799-601-2910	Adapter for BENDIX (MS)	14	MS-14P						●	●												
799-601-3470	Case									●												
799-601-2710	Adapter for MIC	5	MIC-5P	●	●		●							●								
799-601-2720	Adapter for MIC	13	MIC-13P	●	●		●							●								
799-601-2730	Adapter for MIC	17	MIC-17P	●	●	●	●						●	●		●						
799-601-2740	Adapter for MIC	21	MIC-21P	●	●	●	●						●	●		●						
799-601-2950	Adapter for MIC	9	MIC-9P									●	●	●		●						
799-601-2750	Adapter for ECONO	2	ECONO 2P	●	●																	
799-601-2760	Adapter for ECONO	3	ECONO 3P	●	●																	
799-601-2770	Adapter for ECONO	4	ECONO 4P	●	●																	
799-601-2780	Adapter for ECONO	8	ECONO 8P	●	●																	
799-601-2790	Adapter for ECONO	12	ECONO 12P	●	●																	
799-601-2810	Adapter for DLI	8	DLI-8P	●	●																	
799-601-2820	Adapter for DLI	12	DLI-12P	●	●																	
799-601-2830	Adapter for DLI	16	DLI-16P	●	●																	
799-601-2840	Extension cable (ECONO type)	12	ECONO 12P	●	●									●								
799-601-2850	Case			●																		
799-601-4210	Adapter for DRC	50	DRC50																			●
799-601-7010	Adapter for X (T adapter)	1												●		●						
799-601-7020	Adapter for X	2	X2P									●	●	●		●						
799-601-7030	Adapter for X	3	X3P									●	●	●		●						

Part No.	Part name	No. of pins	Identification code	T-adapter kit																out of kit	
				799-601-2500	799-601-2700	799-601-2800	799-601-2900	799-601-3000	799-601-5500	799-601-6000	799-601-6500	799-601-7000	799-601-7100	799-601-7400	799-601-7500	799-601-8000	799-601-9000	799-601-9100	799-601-9200		799-601-9300
799-601-7040	Adapter for X	4	X4P									●	●	●		●					
799-601-7050	Adapter for SWP	6	SW6P									●	●	●							
799-601-7060	Adapter for SWP	8	SW8P									●	●	●							
799-601-7310	Adapter for SWP	12	SW12P																		●
799-601-7070	Adapter for SWP	14	SW14P											●		●					
799-601-7320	Adapter for SWP	16	SW16P																		●
799-601-7080	Adapter for M (T-adapter)	1												●		●					
799-601-7090	Adapter for M	2	M2P									●	●	●		●					
799-601-7110	Adapter for M	3	M3P									●	●	●		●					
799-601-7120	Adapter for M	4	M4P									●	●	●		●					
799-601-7130	Adapter for M	6	M6P									●	●	●		●					
799-601-7340	Adapter for M	8	M8P																		●
799-601-7140	Adapter for S	8	S8P									●	●	●		●					
799-601-7150	Adapter for S (white)	10	S10P									●	●	●		●					
799-601-7160	Adapter for S (blue)	12	S12P									●	●	●							
799-601-7170	Adapter for S (blue)	16	S16P									●	●	●		●					
799-601-7330	Adapter for S (white)	16	S16PW													●					
799-601-7350	Adapter for S (white)	12	S12PW																		●
799-601-7180	Adapter for AMP040	8	A8P											●							
799-601-7190	Adapter for AMP040	12	A12P											●		●					
799-601-7210	Adapter for AMP040	16	A16P									●	●	●		●					
799-601-7220	Adapter for AMP040	20	A20P									●	●	●		●					
799-601-7230	Short socket adapter for X	2										●	●	●		●					
799-601-7240	Case											●	●								
799-601-7270	Case													●							
799-601-7510	Adapter for 070	10	07-10												●						
799-601-7520	Adapter for 070	12	07-12												●						
799-601-7530	Adapter for 070	14	07-14												●						
799-601-7540	Adapter for 070	18	07-18												●						
799-601-7550	Adapter for 070	20	07-20												●						
799-601-7360	Adapter for relay	5	REL-5P																		●
799-601-7370	Adapter for relay	6	REL-6P																		●
799-601-7380	Adapter for JFC	2																			●
799-601-9010	Adapter for DTM	2	DTM2														●		●		
799-601-9020	Adapter for DT	2	DT2														●		●		
799-601-9030	Adapter for DT	3	DT3														●		●		
799-601-9040	Adapter for DT	4	DT4														●		●		
799-601-9050	Adapter for DT	6	DT6														●		●		
799-601-9060	Adapter for DT (gray)	8	DT8GR														●		●		
799-601-9070	Adapter for DT (black)	8	DT8B														●		●		
799-601-9080	Adapter for DT (green)	8	DT8G														●		●		
799-601-9090	Adapter for DT (brown)	8	DT8BR														●		●		
799-601-9110	Adapter for DT (gray)	12	DT12GR														●		●		
799-601-9120	Adapter for DT (black)	12	DT12B														●		●		
799-601-9130	Adapter for DT (green)	12	DT12G														●		●		

Part No.	Part name	No. of pins	Identification code	T-adapter kit																out of kit	
				799-601-2500	799-601-2700	799-601-2800	799-601-2900	799-601-3000	799-601-5500	799-601-6000	799-601-6500	799-601-7000	799-601-7100	799-601-7400	799-601-7500	799-601-8000	799-601-9000	799-601-9100	799-601-9200		799-601-9300
799-601-9140	Adapter for DT	12	DT12BR														●		●		
799-601-9210	Adapter for HD30-18	8	D18-8														●	●			
799-601-9220	Adapter for HD30-18	14	D18-14														●	●			
799-601-9230	Adapter for HD30-18	20	D18-20														●	●			
799-601-9240	Adapter for HD30-18	21	D18-21														●	●			
799-601-9250	Adapter for HD30-24	9	D24-9														●	●			
799-601-9260	Adapter for HD30-24	16	D24-16														●	●			
799-601-9270	Adapter for HD30-24	21	D24-21														●	●			
799-601-9280	Adapter for HD30-24	23	D24-23														●	●			
799-601-9290	Adapter for HD30-24	31	D24-31														●	●			
799-601-9310	Plate for HD30 (24 pins)																●	●		●	
799-601-9320	T-adapter box (for DT and HD)	12															●	●		●	
799-601-9330	Case																●				
799-601-9340	Case																	●			
799-601-9350	Adapter for DRC	40	DRC-40																	●	
799-601-9360	Adapter for DRC	24	DRC-24																	●	
799-601-9410	Adapter for engine (CRI-T2)	2	G																		●
799-601-9420	Adapter for engine (CRI-T2) Adapter for engine (CRI-T3)	3	A3																		●
799-601-9430	Adapter for engine (CRI-T2) Adapter for engine (CRI-T3)	2	P																		●
799-601-9440	Adapter for engine (CRI-T2)	3	1,2,3																		●
795-799-5520	Adapter for engine (HPI-T2)	2	S																		●
795-799-5530	Adapter for engine (HPI-T2) Adapter for engine (CRI-T3)	2	C																		●
795-799-5540	Adapter for engine (HPI-T2) Adapter for engine (CRI-T3)	2	A																		●
795-799-5460	Cable for engine (HPI-T2)	3																			●
795-799-5470	Cable for engine (HPI-T2)	3																			●
795-799-5480	Cable for engine (HPI-T2)	3																			●
799-601-4160	Adapter for engine (CRI-T3)	2	OIL																		●
799-601-4340	Adapter for engine (CRI-T3)	2	1,2,3																		●
799-601-4130	Adapter for engine (CRI-T3)	3	FCIN																		●
799-601-4140	Adapter for engine (CRI-T3)	3	FCIG																		●
799-601-4150	Adapter for engine (CRI-T3)	3	FCIB																		●
799-601-4180	Adapter for engine (CRI-T3)	3	FCIP3																		●
799-601-4190	Adapter for engine (CRI-T3)	3	1,2,3																		●
799-601-4240	Adapter for engine (CRI-T3)	3	1,2,3																		●
799-601-4250	Adapter for engine (CRI-T3)	3	1,2,3																		●
799-601-4330	Adapter for engine (CRI-T3)	3	1,2,3																		●
799-601-4230	Adapter for engine (CRI-T3)	4	1,2,3,4																		●
—	Adapter for controller (ENG)	2	DTP2																		●
799-601-4260	Adapter for controller (ENG)	4	DTP4																		●
799-601-4210	Adapter for controller (ENG)	50	DRC50																		●
799-601-4220	Adapter for controller (ENG)	60	DRC60																		●

Part No.	Part name	No. of pins	Identification code	T-adapter kit																out of kit	
				799-601-2500	799-601-2700	799-601-2800	799-601-2900	799-601-3000	799-601-5500	799-601-6000	799-601-6500	799-601-7000	799-601-7100	799-601-7400	799-601-7500	799-601-8000	799-601-9000	799-601-9100	799-601-9200		799-601-9300
799-601-4280	Box for controller (PUMP)	121																			●
799-601-9720	Adapter for controller (HST)	16	HST16A																		●
799-601-9710	Adapter for controller (HST)	16	HST16B																		●
799-601-9370	Adapter for controller (HST)	26	HST26A																		●

PC160LC-7E0, PC180LC/NLC-7E0 Hydraulic excavator

Form No. UEN02112-00

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Printed in Belgium 09-07 (02)

HYDRAULIC EXCAVATOR

PC160LC-7E0

PC180LC-7E0

PC180NLC-7E0

Machine model Serial number

PC160LC-7E0	K45001 and up
PC180LC-7E0	K45001 and up
PC180NLC-7E0	K45001 and up

40 Troubleshooting

Troubleshooting by failure code, Part 1

Failure code [AA10NX] Air cleaner clogging	3
Failure code [AB00KE] Charge voltage low	4
Failure code [B@BAZG] Eng. oil press. low	6
Failure code [B@BAZK] Eng. oil level low	7
Failure code [B@BCNS] Eng. coolant overheat	8
Failure code [B@BCZK] Eng. coolant level low	10
Failure code [B@HANS] Hydr oil overheat	12
Failure code [CA111] EMC critical internal failure	12
Failure code [CA115] Eng Ne and bkup speed sens error	13
Failure code [CA122] Chg air press sensor high error	15
Failure code [CA123] Chg air press sensor low error	17
Failure code [CA131] Throttle sensor high error	19
Failure code [CA132] Throttle sensor low error	21
Failure code [CA144] Coolant temp sens high error	23
Failure code [CA145] Coolant temp sens low error	25
Failure code [CA153] Chg air temp sensor high error	27

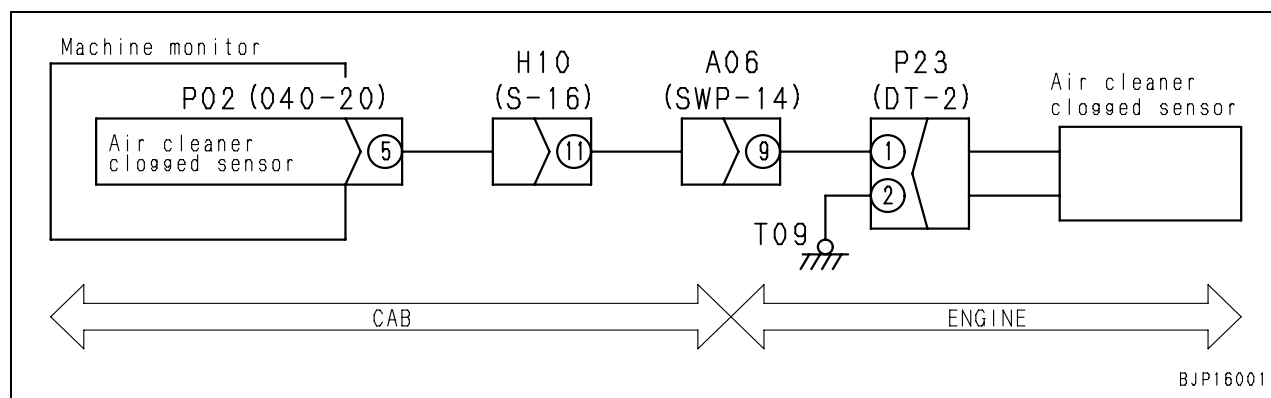
Failure code [CA154] Chg air temp sensor low error	29
Failure code [CA155] Chg air temp high speed derate	31
Failure code [CA187] Sens supply 2 volt low error	33
Failure code [CA221] Ambient press sens high error	35
Failure code [CA222] Ambient press sens low error	37
Failure code [CA227] Sens supply 2 volt high error	39
Failure code [CA234] Eng. overspeed	40
Failure code [CA238] Ne speed sens supply volt error	41
Failure code [CA271] IMV/PCV1 short error	42
Failure code [CA272] IMV/PCV1 open error	43
Failure code [CA322] Inj #1 open/short error	45
Failure code [CA324] Inj #3 open/short error	47

Failure code [AA10NX] Air cleaner clogging

User code	Failure code	Trouble	Air cleaner clogging (Mechanical system)
—	AA10NX		
Contents of trouble	• While engine was running, signal circuit of air cleaner clogging switch was opened (Disconnected with GND).		
Action of machine monitor	• None in particular.		
Problem that appears on machine	• If machine is operated as it is, engine may be damaged.		
Related information	• If an air cleaner clogging caution symbol appears on the machine monitor while the engine is running, this failure code will be recorded. • Input from the air cleaner clogging switch (ON/OFF) can be checked with monitoring function. (Code 04501 : Monitor Input 2)		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Clogging of air cleaner (When system is normal)	★ Check the air cleaner for clogging and then clean or replace it if clogged.			
	2	Defective air cleaner clog- ging switch (Internal disconnection)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			P23 (male)		Air cleaner	Resistance
			Between (1) – (2)	Value in normal state	Max. 1 Ω	
				Value when clogged	Min. 1MΩ	
	3	Disconnection in wiring har- ness (Disconnection in wiring or defective contact in connec- tor)	★ Prepare with starting switch OFF, then carry out troubleshoot- ing without turning starting switch ON.			
			Wiring harness between P02 (female) (5) – H10 – A06 – P23 (female) (1)		Resist- ance	Max. 1 Ω
			Wiring harness between P23 (female) (2) – chassis ground		Resist- ance	Max. 1 Ω
	4	Defective machine monitor	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			P02		Air cleaner	Voltage
			Between (5) – chas- sis ground	Value in normal state	Max. 1 V	
				Value when clogged	20 – 30 V	

Circuit diagram related

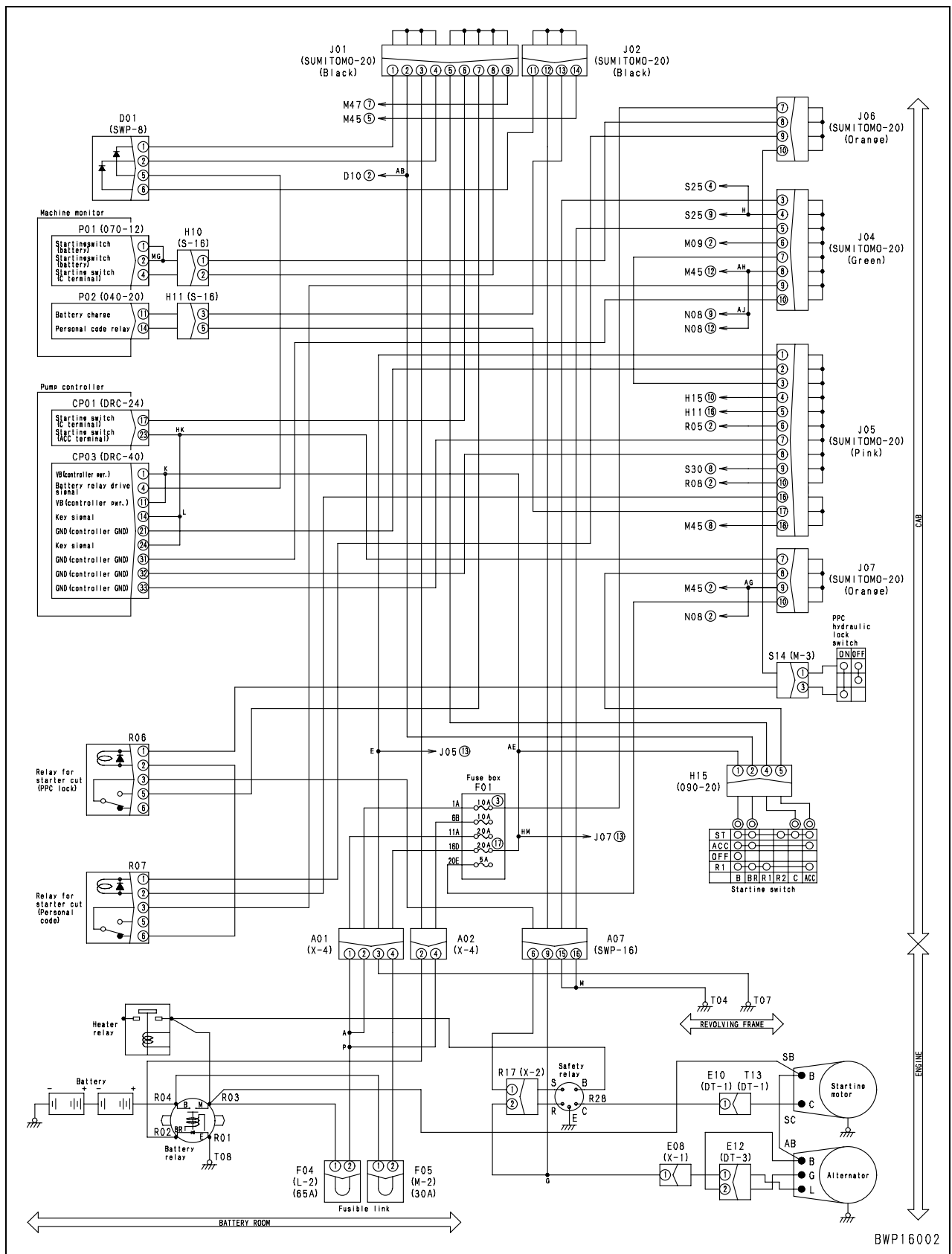


Failure code [AB00KE] Charge voltage low

User code	Failure code	Trouble	Charge voltage low (Mechanical system)
—	AB00KE		
Contents of trouble	• While engine is running, power generation signal from the alternator is not input.		
Action of machine monitor	• None in particular.		
Problem that appears on machine	• If machine is operated as it is, battery may not be charged.		
Related information	• If a charge level caution symbol appears on the machine monitor while the engine is running, this failure code will be recorded. • Input from alternator (voltage) can be checked with monitoring function. (Code 04300 : Charge voltage)		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective alternator (Low power generation)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			Alternator		Engine speed	Voltage
			L terminal – chassis ground		Min. medium speed	27.5 – 29.5 V
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between P02 (female) (11) – H11 – J02 – A07 – E08 – E12 – Alternator L terminal		Resistance	Max. 1 Ω
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between P02 (female) (11) – H11 – J02 – A07 – E08 – E12 – Alternator L terminal, between P02 (female) (11) – H11 – J02 – D01 (female) (6) and between P02 (female) (11) – H11 – J02 – R17 (female) (2) with chassis ground		Resistance	Min. 1MΩ
	4	Defective machine monitor	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			P02	Engine speed	Voltage	
			Between (11) – chassis ground	Min. medium speed	27.5 – 29.5 V	

Circuit diagram related

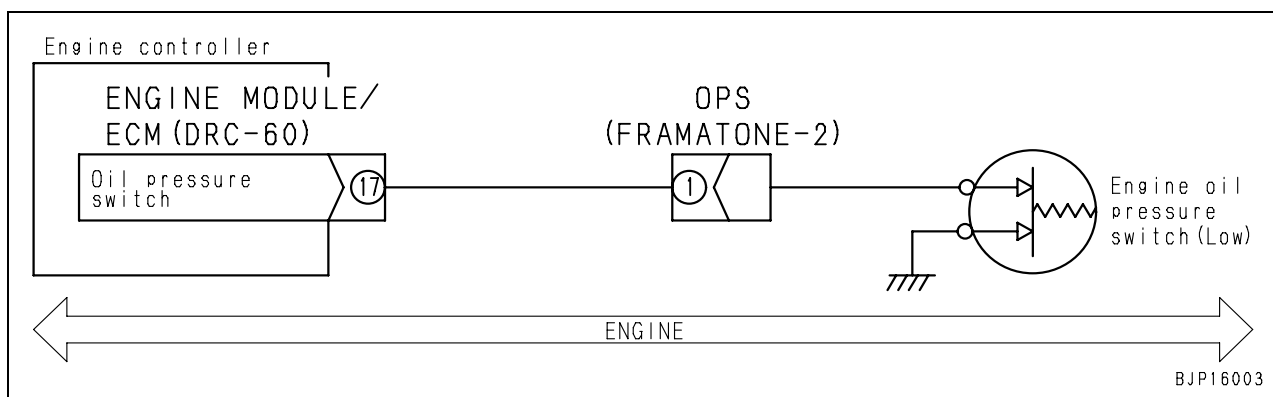


Failure code [B@BAZG] Eng. oil press. low

User code	Failure code	Trouble	Engine oil pressure low (Engine controller system)
—	B@BAZG		
Contents of trouble	• While engine was running, signal circuit of engine oil pressure switch detected low engine oil pressure (sensor contact closed).		
Action of controller	• Displays engine oil pressure monitor on machine monitor. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• If machine is operated as it is, engine may be damaged.		
Related information	• Engine oil pressure switch signal is input to engine controller and then transmitted to machine monitor. • Method of reproducing failure code: Start engine		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Lowering of engine oil pressure (When system is normal)	★ Determine the cause and check the damage to the engine and then modify it.			
	2	Defective engine oil pressure switch	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			OPS (male)		Resistance	
			Between (1) – chassis ground		Max. 10 Ω	
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ECM (female) (17) – OPS (male) (1)		Resistance	Max. 10 Ω
	4	Short circuit in wiring harness (With another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ECM (female) (17) – each of ECM (female) pins (With all wiring harness connectors disconnected)		Resistance	Min. 100 kΩ
	5	Defective engine controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			ECM		Resistance	
			Between (17) – chassis ground		Max. 10 Ω	

Circuit diagram related

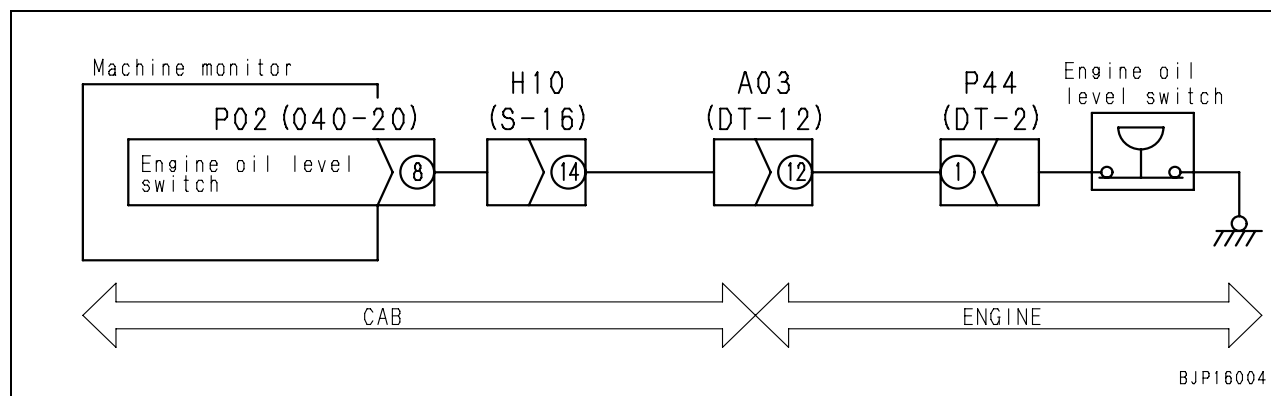


Failure code [B@BAZK] Eng. oil level low

User code	Failure code	Trouble	Engine oil level low (Machine monitor system)
—	B@BAZK		
Contents of trouble	• When starting switch is turned ON (but engine is not started), signal circuit of engine oil level switch detected low engine oil level (sensor contact opened).		
Action of machine monitor	• Displays engine oil level monitor on machine monitor. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• If machine is operated as it is, engine may be damaged.		
Related information	• Engine oil level switch signal can be checked with monitoring function. (Code 04501 : Monitor Input 2) • Method of reproducing failure code: Turn starting switch ON.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Lowering of engine oil level (When system is normal)	★ Check the engine oil level and add new oil. (If this phenomenon frequently occurs, investigate the cause.)			
	2	Defective engine oil level switch (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			P44 (male)	Engine oil level	Resistance	
			Between (1) – chassis ground	Value in normal state	Max. 1 Ω	
				Value when oil level is low	Min. 1MΩ	
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between P02 (female) (8) – H10 – A03 – P44 (female) (1)		Resistance	Max. 1 Ω
	4	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			P02	Engine oil level	Voltage	
Between (8) – chassis ground			Value in normal state	Max. 1 V		
			Value when oil level is low	20 – 30 V		

Circuit diagram related

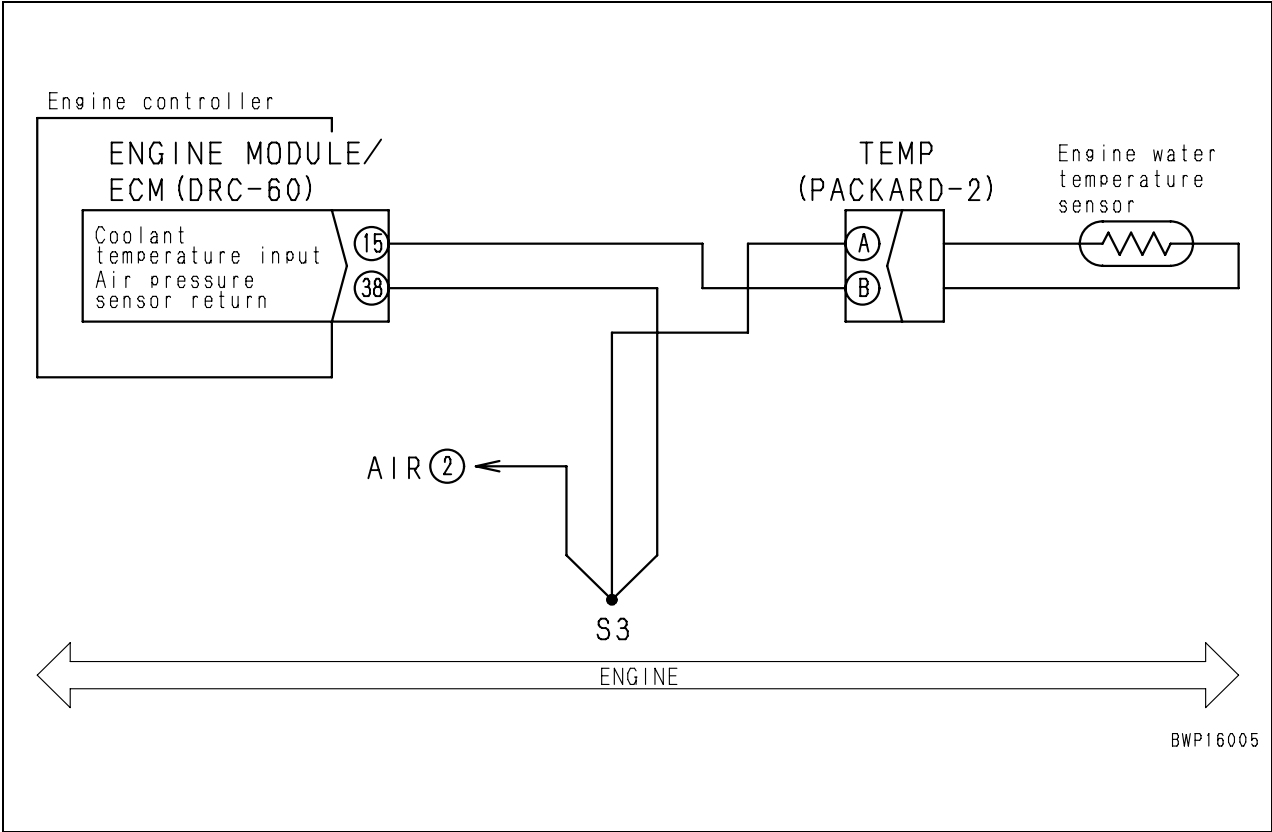


Failure code [B@BCNS] Eng. coolant overheat

User code	Failure code	Trouble	Engine coolant overheat (Engine controller system)
—	B@BCNS		
Contents of trouble	• While engine was running, signal circuit of engine coolant temperature sensor detected overheating of engine coolant (above 102°C).		
Action of machine monitor	• Displays engine coolant temperature monitor with red on machine monitor. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• If machine is operated as it is, engine may be seized.		
Related information	• Engine coolant temperature sensor signal is input to engine controller and then transmitted to machine monitor. • Engine coolant temperature can be checked with monitoring function. (Code 04107 : Engine coolant temperature) • Method of reproducing failure code: Start engine		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Overheating of engine (When system is normal)	★ Determine the cause and check the damage to the engine and then modify it.			
	2	Defective coolant temperature sensor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			TEMP (male)		Resistance	
			Between (A) – (B)		0.18 – 160 kΩ	
	3	Short circuit in wiring harness (With another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ECM (female) (15) – each of ECM (female) pins (With all wiring harness connectors disconnected)		Resistance	Min. 100 kΩ
	4	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			ECM (female)		Resistance	
			Between (15) – (38)		0.18 – 160 kΩ	

Circuit diagram related

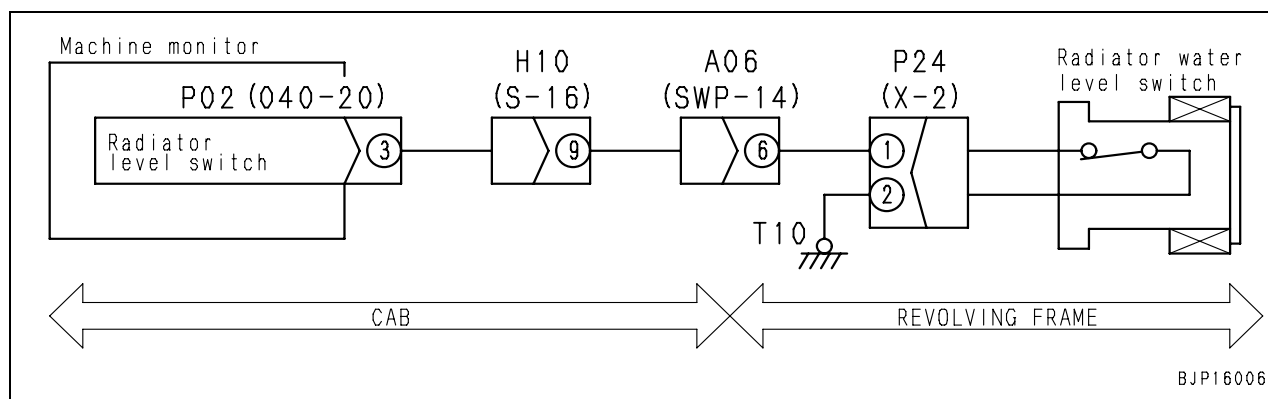


Failure code [B@BCZK] Eng. coolant level low

User code	Failure code	Trouble	Engine coolant level low (Mechanical system)
—	B@BCZK		
Contents of trouble	• While engine was running, signal circuit of radiator coolant level switch was opened (Disconnected with GND).		
Action of machine monitor	• None in particular.		
Problem that appears on machine	• If machine is operated as it is, engine may overheat.		
Related information	• If radiator coolant level caution symbol appears on the machine monitor while the engine is running, this failure code will be recorded. • Input from the radiator coolant level switch (ON/OFF) can be checked with monitoring function. (Code 04500 : Monitor Input 1)		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Lowering of radiator coolant level (When system is normal)	★ Check the coolant level and add coolant. (If this phenomenon frequently occurs, investigate the cause.)			
	2	Defective radiator coolant level switch (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			P24 (male)	Radiator coolant level	Resistance	
			Between (1) – (2)	Value in normal state	Max. 1 Ω	
				Value when coolant level is low	Min. 1MΩ	
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between P02 (female) (3) – P24 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between P24 (female) (2) – chassis ground		Resistance	Max. 1 Ω
	4	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			P02	Radiator coolant level	Voltage	
			Between (3) – chassis ground	Value in normal state	Max. 1 V	
				Value when coolant level is low	20 – 30 V	

Circuit diagram related



Failure code [B@HANS] Hydr oil overheat

User code	Failure code	Trouble	Hydraulic oil overheat (Pump controller system)
—	B@HANS		
Contents of trouble	• While engine was running, signal circuit of hydraulic oil temperature sensor detected overheating of hydraulic oil (above about 102°C).		
Action of controller	• Displays hydraulic oil temperature monitor with red on machine monitor. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• If machine is operated as it is, engine may be seized.		
Related information	• Hydraulic oil temperature sensor signal is input to engine controller and then transmitted to machine monitor. • Hydraulic oil temperature can be checked with monitoring function (Code 04401 : Hydraulic oil temperature) • Method of reproducing failure code: Start engine.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Overheating of hydraulic oil (When system is normal)	
	2	Defective hydraulic oil temperature gauge system	If cause 1 is not detected, hydraulic oil temperature gauge system may be defective. Carry out troubleshooting for "E-12 Hydraulic oil temperature gauge does not work normally" in E-mode.

Failure code [CA111] EMC critical internal failure

User code	Failure code	Trouble	EMC critical internal failure (Engine controller system)
E10	CA111		
Contents of trouble	• Memory or power supply circuit in engine controller is defective.		
Action of controller	• None in particular.		
Problem that appears on machine	• Engine runs normally but may stop during operation or may not be able to start.		
Related information			

Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting for failure code [CA757].	

Failure code [CA115] Eng Ne and bkup speed sens error

User code	Failure code	Trouble	Engine Ne and bkup speed sensor error (Engine controller system)
E10	CA115		
Contents of trouble	• Both signals of engine Ne speed sensor and engine bkup speed sensor are abnormal.		
Action of controller	• None in particular.		
Problem that appears on machine	• Engine stops. • Engine does not start.		
Related information	• Method of reproducing failure code: Start engine.		

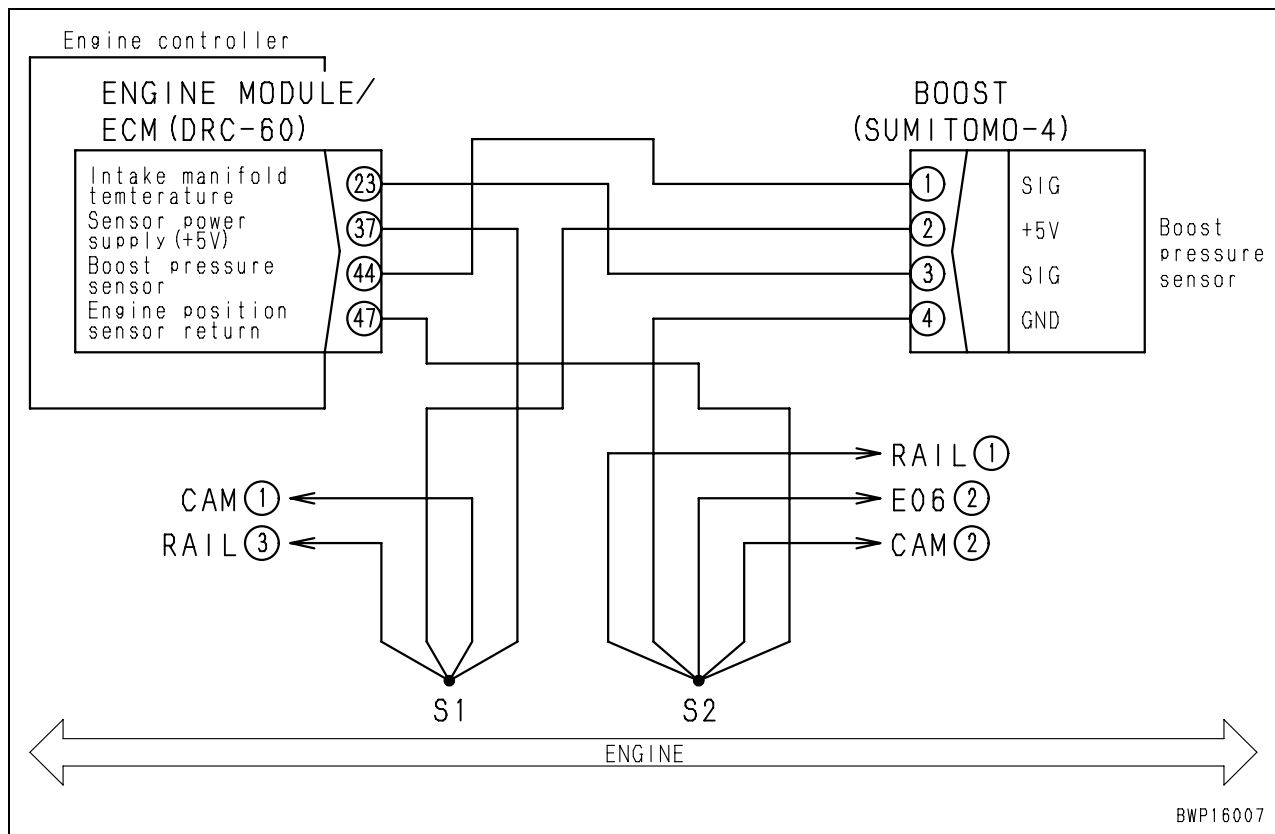
Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective Ne speed sensor system	Carry out troubleshooting for failure code [CA689].
	2	Defective Bkup speed sensor system	Carry out troubleshooting for failure code [CA778].
	3	Defective installation of Ne speed sensor	Ne speed sensor may be installed defectively. Check it directly. (Defective installation of sensor itself, internal defect of flywheel, etc.)
	4	Defective installation of Bkup speed sensor	Bkup speed sensor may be installed defectively. Check it directly. (Defective installation of sensor itself, internal defect of supply pump, etc.)
	5	Defective connection of sensor connector (Wrong connection)	Ne speed sensor and Bkup speed sensor may be connected defectively (or connected to wrong parts). Check them directly.
	6	Defective engine controller	If causes 1 – 5 are not detected, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

Failure code [CA122] Chg air press sensor high error

User code	Failure code	Trouble	Charge air pressure sensor high error (Engine controller system)
E11	CA122		
Contents of trouble	• Pressure signal circuit of boost pressure/temperature sensor detected high voltage.		
Action of controller	• Fixes charge pressure value and continues operation.		
Problem that appears on machine	• Engine output lowers.		
Related information	• Signal voltage on boost pressure side of boost pressure/temperature sensor can be checked with monitoring function. (Code 36501 : Boost pressure sensor voltage) • Method of reproducing failure code: Turn starting switch ON.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective sensor power supply 2 system	If failure code [CA227] is also indicated, carry out troubleshooting for it first.			
	2	Defective boost pressure/temperature sensor [Pressure signal system]	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			BOOST		Voltage	
			Between (2) – (4)	Power supply	4.75 – 5.25 V	
			Voltage is measured with wiring harness connected. Accordingly, if voltage is abnormal, check wiring harness and controller, too, for another cause of trouble, and then judge.			
	3	Hot short (Short circuit with 5 V/24 V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between ECM (female) (44) – BOOST (female) (1)		Voltage	Max. 1 V
	4	Short circuit in wiring harness (With another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ECM (female) (44) – BOOST (female) (1) and between ECM (female) (37) – S1 – BOOST (female) (2)		Resistance	Min. 100 kΩ
	5	Defective wiring harness connector	Connecting parts between boost pressure/temperature sensor – engine wiring harness – engine controller may be defective. Check them directly. <ul style="list-style-type: none">Looseness of connector, breakage of lock, or breakage of sealCorrosion, bend, breakage, push-in, or expansion of pinMoisture or dirt in connector or defective insulation			
	6	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			ECM		Voltage	
			Between (37) – (47)	Power supply	4.75 – 5.25 V	

Circuit diagram related

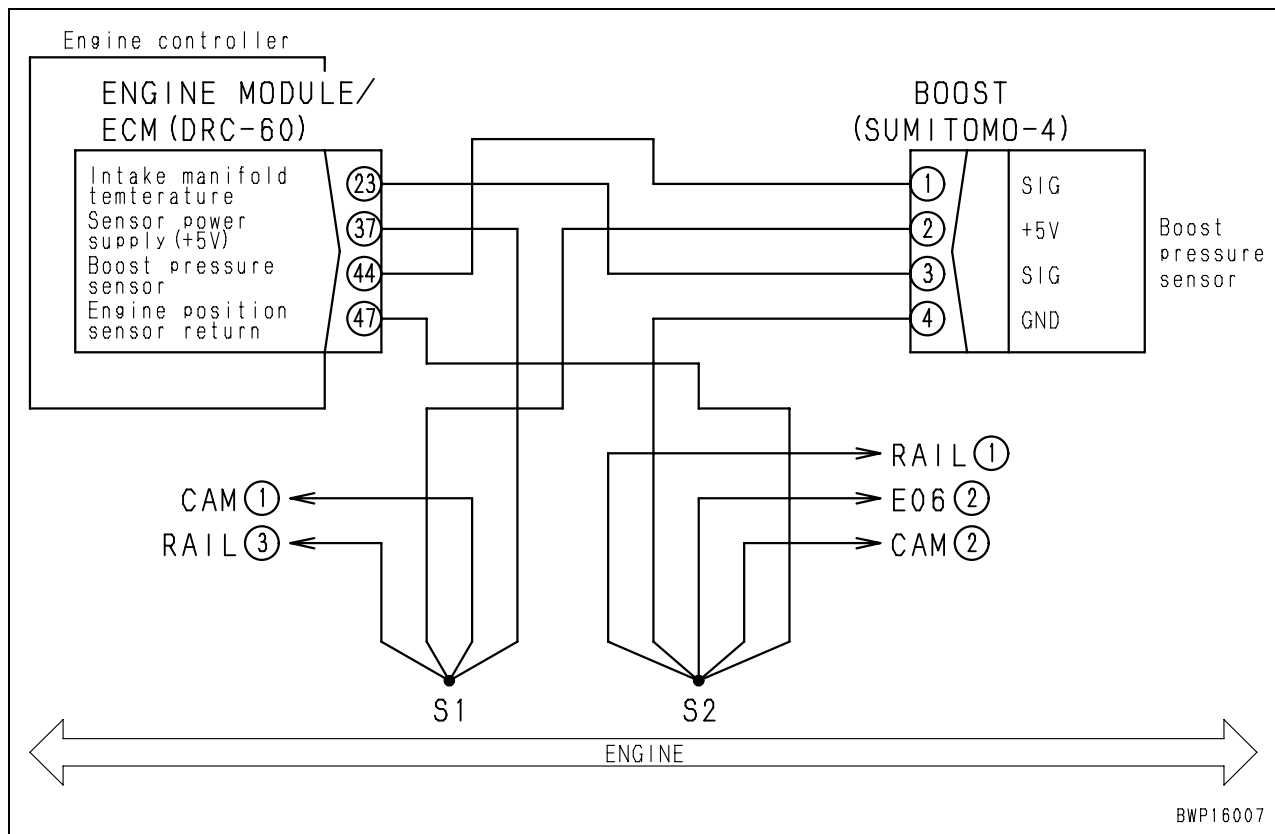


Failure code [CA123] Chg air press sensor low error

User code	Failure code	Trouble	Charge air pressure sensor low error (Engine controller system)
E11	CA123		
Contents of trouble	• Pressure signal circuit of boost pressure/temperature sensor detected low voltage.		
Action of controller	• Fixes charge pressure value and continues operation.		
Problem that appears on machine	• Engine output lowers.		
Related information	• Signal voltage on boost pressure side of boost pressure/temperature sensor can be checked with monitoring function. (Code 36501 : Boost pressure sensor voltage) • Method of reproducing failure code: Turn starting switch ON.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective sensor power supply 2 system	If failure code [CA187] is also indicated, carry out troubleshooting for it first.		
	2	Defective charge air pressure, temperature sensor [Pressure signal system]	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			BOOST		Voltage
			Between (2) – (4)	Power supply	4.75 – 5.25 V
			Voltage is measured with wiring harness connected. Accordingly, if voltage is abnormal, check wiring harness and controller, too, for another cause of trouble, and then judge.		
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ECM (female) (44) – BOOST (female) (1) and chassis ground	Resistance	Min. 100 kΩ
	4	Short circuit in wiring harness (With another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ECM (female) (44) – BOOST (female) (1) and between ECM (female) (47) – S2 – BOOST (female) (4)	Resistance	Min. 100 kΩ
	5	Defective wiring harness connector	Connecting parts between charge air pressure, temperature sensor – engine wiring harness – engine controller may be defective. Check them directly. <ul style="list-style-type: none"> Looseness of connector, breakage of lock, or breakage of seal Corrosion, bend, breakage, push-in, or expansion of pin Moisture or dirt in connector or defective insulation 		
	6	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			CE01		Voltage
			Between (37) – (47)	Power supply	4.75 – 5.25 V

Circuit diagram related

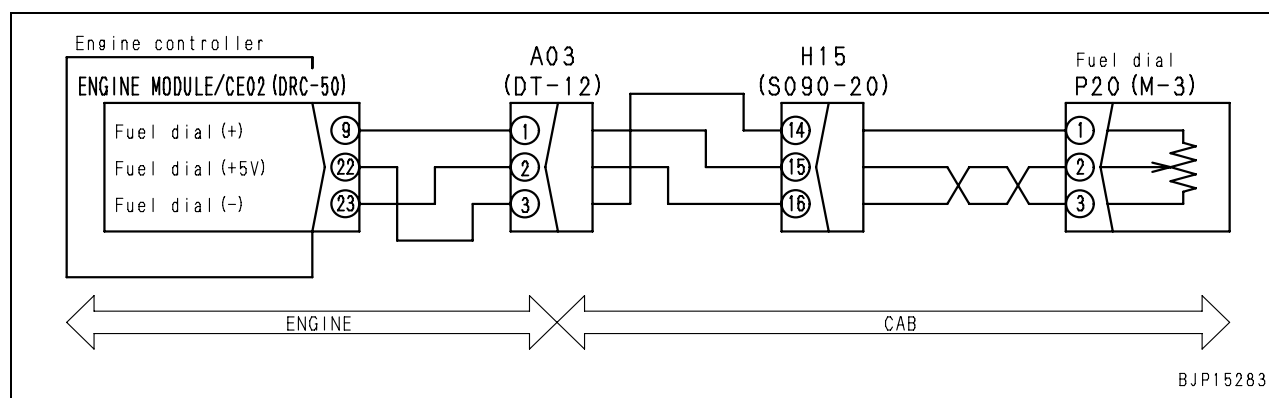


Failure code [CA131] Throttle sensor high error

User code	Failure code	Trouble	Throttle sensor high error (Engine controller system)
E14	CA131		
Contents of trouble	<ul style="list-style-type: none"> Signal circuit of fuel control dial detected high voltage. 		
Action of controller	<ul style="list-style-type: none"> If trouble occurs while starting switch is in ON position, controller fixes voltage value to level just before detection of trouble and continues operation. If starting switch is turned ON while voltage is abnormally high, controller continues operation with voltage at 100% value. 		
Problem that appears on machine	<ul style="list-style-type: none"> Engine speed cannot be controlled with fuel control dial. 		
Related information	<ul style="list-style-type: none"> Signal voltage of fuel control dial can be checked with monitoring function. (Code 03000: Fuel control dial voltage) Method of reproducing failure code: Turn starting switch ON. 		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective throttle sensor power supply system	If failure code [CA2185] is also indicated, carry out troubleshooting for it first.			
	2	Defective fuel control dial	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			P20		Voltage	
			Between (1) – (3)	Power supply	4.75 – 5.25 V	
			Voltage is measured with wiring harness connected. Accordingly, if voltage is abnormal, check wiring harness and controller, too, for another cause of trouble, and then judge.			
	3	Hot short (Short circuit with 5 V/24 V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between CE02 (female) (9) – P20 (female) (2)		Voltage	Max. 1 V
	4	Short circuit in wiring harness (With another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CE02 (female) (9) – P20 (female) (2) and between CE02 (female) (22) – P20 (female) (1)		Resistance	Min. 100 kΩ
	5	Defective wiring harness connector	Connecting parts between fuel control dial – machine wiring harness – engine controller may be defective. Check them directly. <ul style="list-style-type: none">• Looseness of connector, breakage of lock, or breakage of seal• Corrosion, bend, breakage, push-in, or expansion of pin• Moisture or dirt in connector or defective insulation			
	6	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			CE02		Voltage	
			Between (22) – (23)	Power supply	4.75 – 5.25 V	

Circuit diagram related

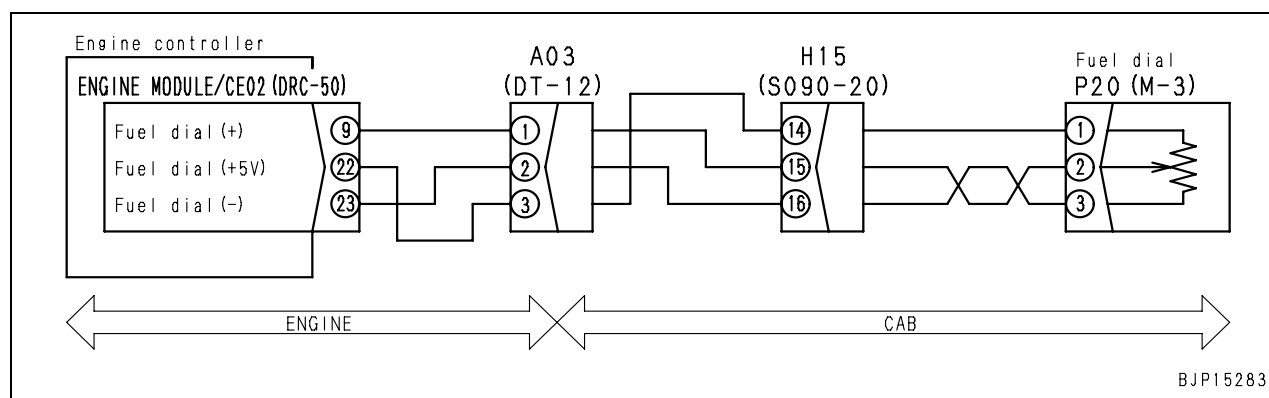


Failure code [CA132] Throttle sensor low error

User code	Failure code	Trouble	Throttle sensor low error (Engine controller system)
E14	CA132		
Contents of trouble	• Signal circuit of fuel control dial detected low voltage.		
Action of controller	<ul style="list-style-type: none"> • If trouble occurs while starting switch is in ON position, controller fixes voltage value to level just before detection of trouble and continues operation. • If starting switch is turned ON while voltage is abnormally high, controller continues operation with voltage at 100% value. 		
Problem that appears on machine	• Engine speed cannot be controlled with fuel control dial.		
Related information	<ul style="list-style-type: none"> • Signal voltage of fuel control dial can be checked with monitoring function. (Code 03000: Fuel control dial voltage) • Method of reproducing failure code: Turn starting switch ON. 		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective throttle sensor power supply system	If failure code [CA2186] is also indicated, carry out troubleshooting for it first.		
	2	Defective fuel control dial	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			P20		Voltage
			Between (1) – (3)	Power supply	4.75 – 5.25 V
			Voltage is measured with wiring harness connected. Accordingly, if voltage is abnormal, check wiring harness and controller, too, for another cause of trouble, and then judge.		
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
	4	Short circuit in wiring harness (With another wiring harness)	Wiring harness between CE02 (female) (9) – P20 (female) (2)		Resistance
			Wiring harness between CE02 (female) (9) – P20 (female) (2) and between CE02 (female) (23) – P20 (female) (3)		Min. 100 kΩ
	5	Defective wiring harness connector	Connecting parts between fuel control dial – machine wiring harness – engine controller may be defective. Check them directly. <ul style="list-style-type: none"> • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation 		
	6	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			CE02		Voltage
			Between (22) – (23)	Power supply	4.75 – 5.25 V

Circuit diagram related

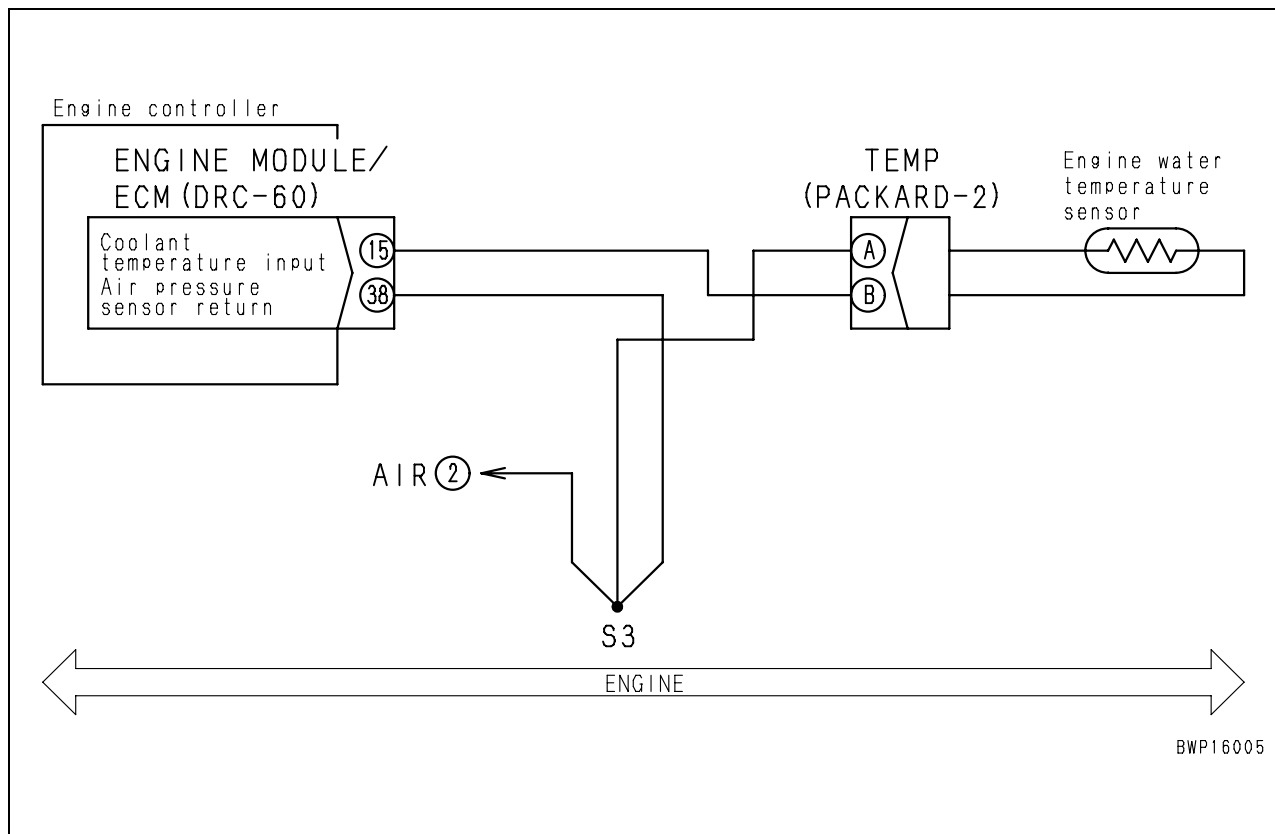


Failure code [CA144] Coolant temp sens high error

User code	Failure code	Trouble	Coolant temperature sensor high error (Engine controller system)
E15	CA144		
Contents of trouble	• Signal circuit of coolant temperature sensor detected high voltage.		
Action of controller	• Fixes coolant temperature value and continues operation.		
Problem that appears on machine	• Startability of engine lowers at low temperature. • Exhaust gas becomes white. • Overheat prevention function does not work.		
Related information	• Signal voltage of coolant temperature sensor can be checked with monitoring function. (Code 04105 : Coolant temperature sensor voltage) • Method of reproducing failure code: Turn starting switch ON.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective coolant temperature sensor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			TEMP (male)		Resistance
			Between (A) – (B)		0.18 – 160 kΩ
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ECM (female) (15) – TEMP (female) (B)	Resistance	Max. 10 Ω
			Wiring harness between ECM (female) (38) – S3 – TEMP (female) (A)	Resistance	Max. 10 Ω
	3	Short circuit in wiring harness (With another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ECM (female) (15) – each of ECM (female) pins (With all wiring harness connectors disconnected)	Resistance	Min. 100 kΩ
	4	Defective wiring harness connector	Connecting parts between coolant temperature sensor – engine wiring harness – engine controller may be defective. Check them directly. <ul style="list-style-type: none"> Looseness of connector, breakage of lock, or breakage of seal Corrosion, bend, breakage, push-in, or expansion of pin Moisture or dirt in connector or defective insulation 		
	5	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			ECM (female)		Resistance
			Between (15) – (38)		0.18 – 160 kΩ

Circuit diagram related

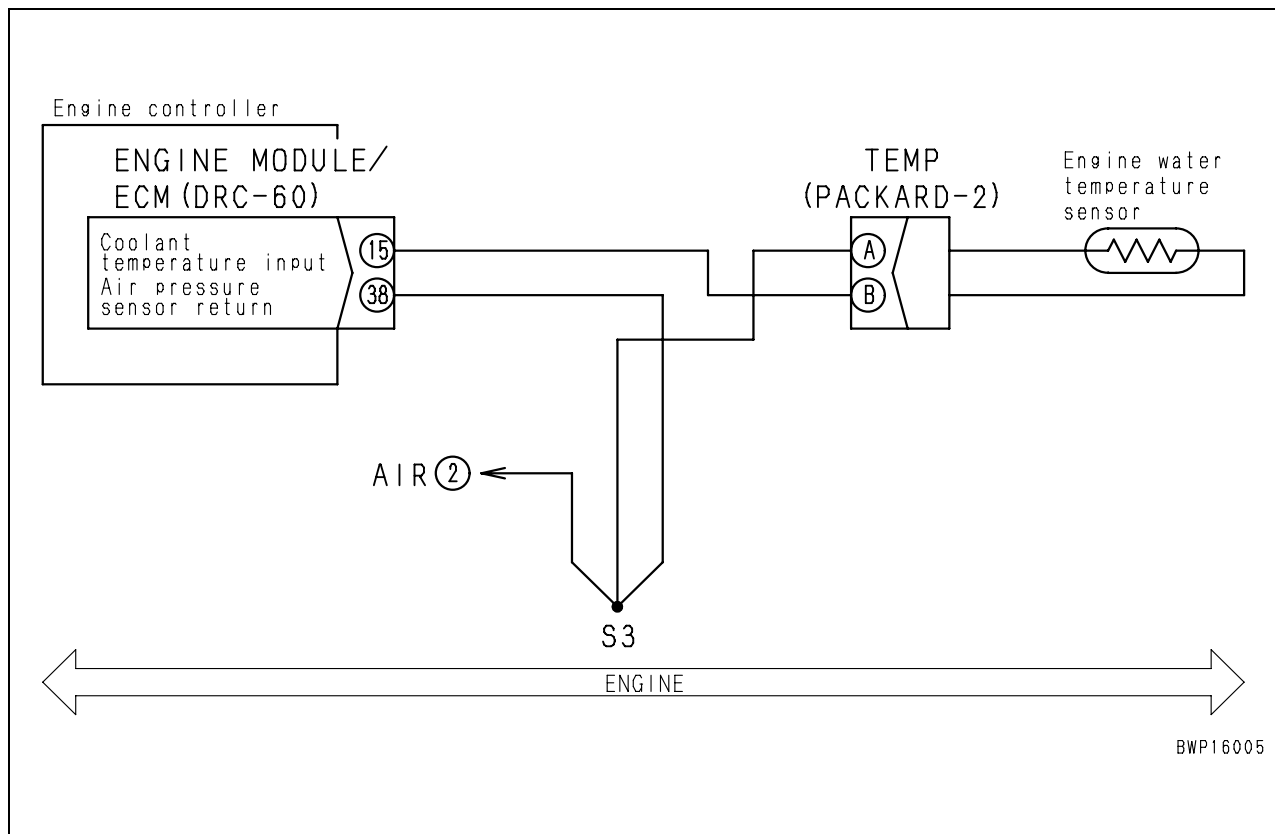


Failure code [CA145] Coolant temp sens low error

User code	Failure code	Trouble	Coolant temperature sensor low error (Engine controller system)
E15	CA145		
Contents of trouble	• Signal circuit of coolant temperature sensor detected low voltage.		
Action of controller	• Fixes coolant temperature value and continues operation.		
Problem that appears on machine	• Startability of engine lowers at low temperature. • Exhaust gas becomes white. • Overheat prevention function does not work.		
Related information	• Signal voltage of coolant temperature sensor can be checked with monitoring function. (Code 04105 : Coolant temperature sensor voltage) • Method of reproducing failure code: Turn starting switch ON.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective coolant temperature sensor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			TEMP (male)		Resistance	
			Between (A) – (B)		0.18 – 160 kΩ	
			Between (B) – chassis ground		Min. 100 kΩ	
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ECM (female) (15) – TEMP (female) (B) and chassis ground		Resistance	Min. 100 kΩ
	3	Short circuit in wiring harness (With another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Between ECM (female) (15) – each of ECM (female) pins (With all wiring harness connectors disconnected)		Resistance	Min. 100 kΩ
	4	Defective wiring harness connector	Connecting parts between coolant temperature sensor – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation			
	5	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			ECM (female)		Resistance	
			Between (15) – (38)		0.18 – 160 kΩ	
			Between (15) – chassis ground		Min. 100 kΩ	

Circuit diagram related

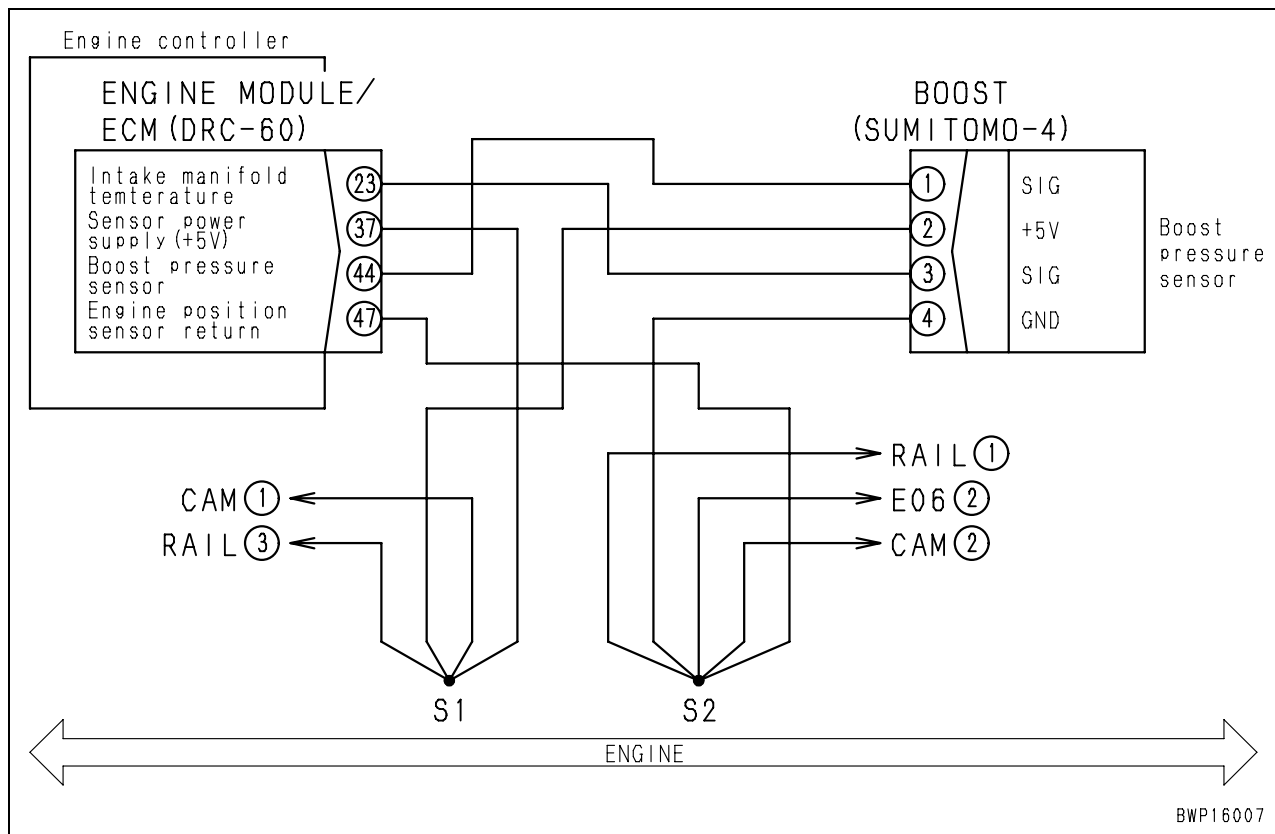


Failure code [CA153] Chg air temp sensor high error

User code	Failure code	Trouble	Charge air temperature sensor high error (Engine controller system)
E15	CA153		
Contents of trouble	• Temperature signal circuit of boost pressure/temperature sensor detected high voltage.		
Action of controller	• Fixes charge temperature value and continues operation.		
Problem that appears on machine	• Exhaust gas becomes white. • Engine protection function based on boost temperature does not work		
Related information	• Signal voltage on boost temperature side of boost pressure/temperature sensor can be checked with monitoring function. (Code 18501 : Boost temperature sensor voltage) • Method of reproducing failure code: Turn starting switch ON.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective boost pressure/temperature sensor [Temperature signal system]	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			BOOST (male)		Resistance
			Between (3) – (4)		0.18 – 160 kΩ
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ECM (female) (23) – BOOST (female) (3)	Resistance	Max. 10 Ω
			Wiring harness between ECM (female) (47) – JC02 – BOOST (female) (4)	Resistance	Max. 10 Ω
	3	Short circuit in wiring harness (With another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ECM (female) (23) – each of ECM (female) pins (With all wiring harness connectors disconnected)	Resistance	Min. 100 kΩ
	4	Defective wiring harness connector	Connecting parts between boost pressure/temperature sensor – engine wiring harness – engine controller may be defective. Check them directly. <ul style="list-style-type: none"> Looseness of connector, breakage of lock, or breakage of seal Corrosion, bend, breakage, push-in, or expansion of pin Moisture or dirt in connector or defective insulation 		
	5	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			ECM (female)		Resistance
			Between (23) – (47)		0.18 – 160 kΩ

Circuit diagram related

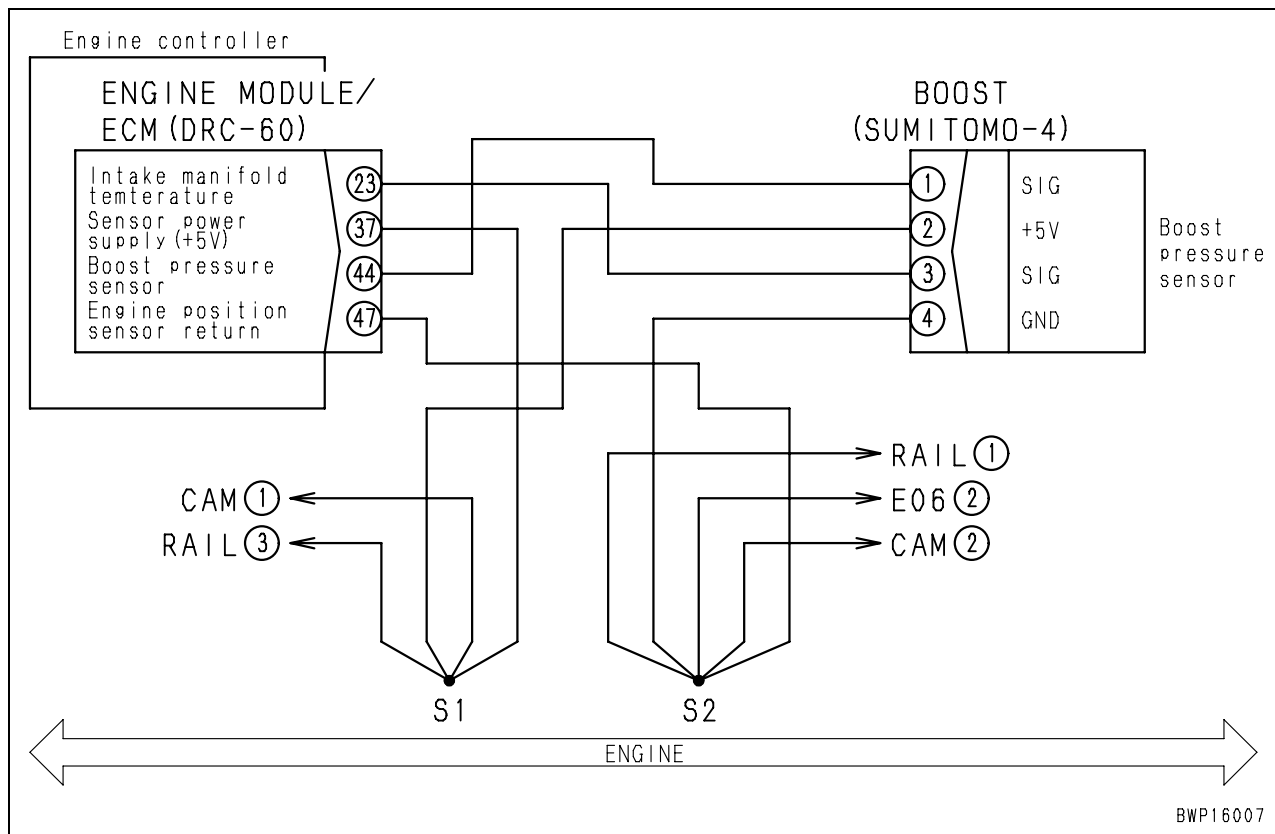


Failure code [CA154] Chg air temp sensor low error

User code	Failure code	Trouble	Charge air temperature sensor low error (Engine controller system)
E15	CA154		
Contents of trouble	<ul style="list-style-type: none"> Temperature signal circuit of boost pressure, temperature sensor detected low voltage. 		
Action of controller	<ul style="list-style-type: none"> Fixes charge temperature value and continues operation. 		
Problem that appears on machine	<ul style="list-style-type: none"> Exhaust gas becomes white. Engine protection function based on boost temperature does not work 		
Related information	<ul style="list-style-type: none"> Signal voltage on boost temperature side of boost pressure/temperature sensor can be checked with monitoring function. (Code 18501: Boost temperature sensor voltage) Method of reproducing failure code: Turn starting switch ON. 		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective boost pressure, temperature sensor [Temperature signal system]	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			BOOST (male)		Resistance
			Between (3) – (4)		0.18 – 160 kΩ
			Between (3) – chassis ground		Min. 100 kΩ
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ECM (female) (23) – BOOST (female) (3) and chassis ground	Resistance	Min. 100 Ω
	3	Short circuit in wiring harness (With another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Between ECM (female) (23) – each of ECM (female) pins (With all wiring harness connectors disconnected)	Resistance	Min. 100 kΩ
	4	Defective wiring harness connector	Connecting parts between charge air pressure, temperature sensor – engine wiring harness – engine controller may be defective. Check them directly. <ul style="list-style-type: none">Looseness of connector, breakage of lock, or breakage of sealCorrosion, bend, breakage, push-in, or expansion of pinMoisture or dirt in connector or defective insulation		
	5	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			ECM (female)		Resistance
			Between (23) – (47)		0.18 – 160 kΩ
			Between (23) – chassis ground		Min. 100 kΩ

Circuit diagram related



Failure code [CA155] Chg air temp high speed derate

User code	Failure code	Trouble	Charge air temperature high speed derate (Engine controller system)
E11	CA155		
Contents of trouble	• Temperature signal of boost pressure/temperature sensor exceeded control upper temperature limit.		
Action of controller	• Limits output and continues operation.		
Problem that appears on machine	• Engine output lowers. • Engine stops.		
Related information	• Boost temperature can be checked with monitoring function. (Code 18500 : Boost temperature) • Method of reproducing failure code: Start engine		

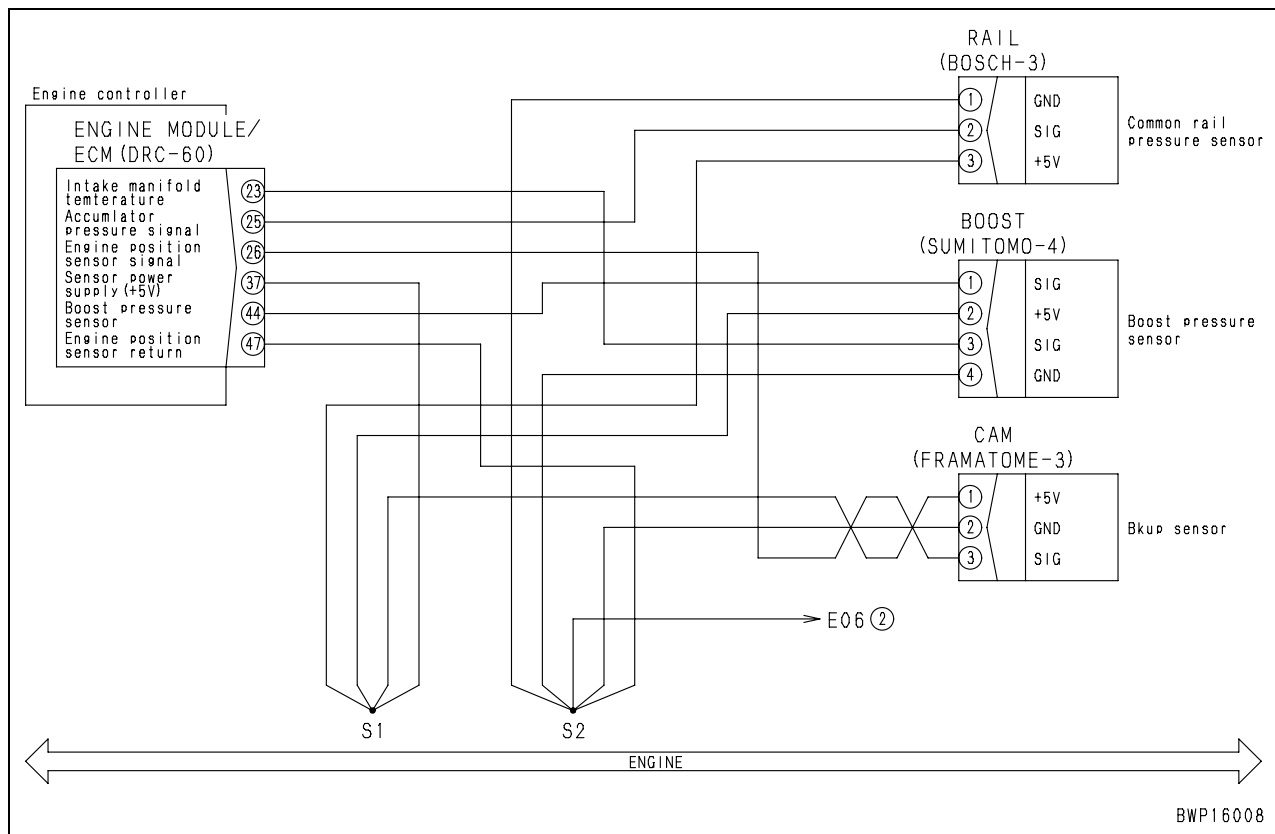
Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Lowering of cooling performance of aftercooler	Cooling performance of aftercooler may be low. Check following points directly. <ul style="list-style-type: none"> Looseness and breakage of fan belt. Insufficiency of cooling air Clogging of aftercooler fins
	2	Abnormal rise of turbo-charger outlet temperature	Outlet temperature of turbocharger may be abnormally high. Check related parts directly.
	3	Defective engine controller	If causes 1 – 2 are not detected, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

Failure code [CA187] Sens supply 2 volt low error

User code	Failure code	Trouble	Sensor supply 2 voltage low error (Engine controller system)
E15	CA187		
Contents of trouble	• Low voltage was detected in sensor power supply 2 circuit.		
Action of controller	• Fixes boost pressure value and continues operation. • Fixes charge temperature value and continues operation. • Limits output and continues operation.		
Problem that appears on machine	• Engine output lowers.		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective sensor or wiring harness	★ Disconnect connector with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Disconnect sensors and wiring harness at right in order and carry out operation to reproduce trouble. If "E" of failure code goes off when a sensor or wiring harness is disconnected, that sensor or wiring harness is defective.	Boost pressure/temperature sensor	BOOST
				Common rail pressure sensor	RAIL
				Bkup sensor	CAM
				Engine wiring harness	ECM
	2	Defective wiring harness connector	Connecting parts between each sensor – engine wiring harness – engine controller may be defective. Check them directly. <ul style="list-style-type: none"> Looseness of connector, breakage of lock, or breakage of seal Corrosion, bend, breakage, push-in, or expansion of pin Moisture or dirt in connector or defective insulation 		
	3	Defective engine controller	If causes 1 – 2 are not detected, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

Circuit diagram related

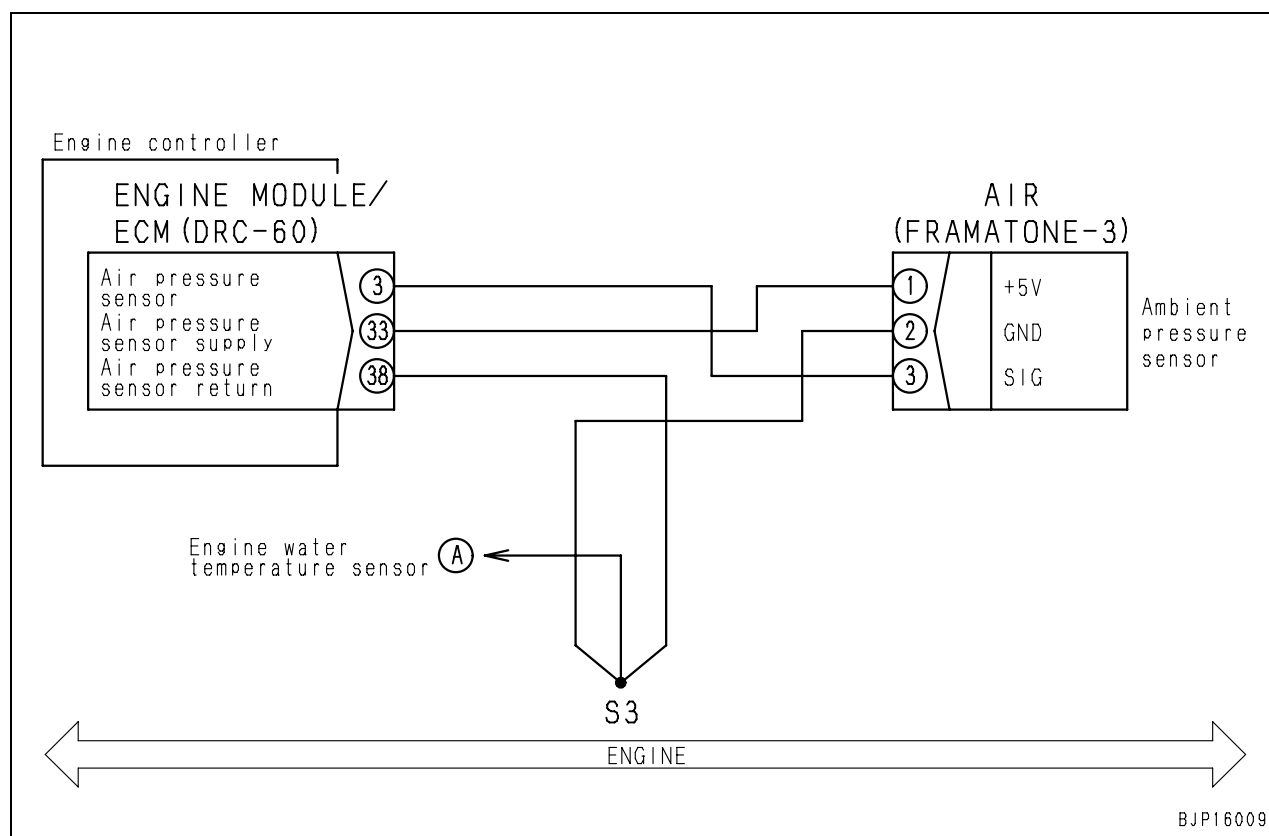


Failure code [CA221] Ambient press sens high error

User code	Failure code	Trouble	Ambient pressure sensor high error (Engine controller system)
E11	CA221		
Contents of trouble	• High voltage was detected in signal circuit of ambient pressure sensor.		
Action of controller	• Fixes ambient pressure value and continues operation.		
Problem that appears on machine	• Engine does not start easily. • Engine output lowers.		
Related information	• Signal voltage of ambient pressure sensor can be checked with monitoring function. (Code 37401 : Ambient pressure sensor voltage) • Method of reproducing failure code: Turn starting switch ON.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective sensor power supply 1 system	If failure code [CA386] is also indicated, carry out troubleshooting for it first.			
	2	Defective ambient pressure sensor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			AIR		Voltage	
			Between (1) – (2)	Power supply	4.75 – 5.25V	
			Voltage is measured with wiring harness connected. Accordingly, if voltage is abnormal, check wiring harness and controller, too, for another cause of trouble, and then judge.			
	3	Hot short (Short circuit with 5V/24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between ECM (female) (3) – AIR (female) (3)		Voltage	Max. 1 V
	4	Short circuit in wiring harness (With another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ECM (female) (3) – AIR (female) (3) and between ECM (female) (33) – AIR (female) (1)		Resistance	Min. 100 kΩ
	5	Defective wiring harness connector	Connecting parts between ambient pressure sensor – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation			
	6	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			ECM		Voltage	
Between (33) – (38)			Voltage	4.75 – 5.25 V		

Circuit diagram related

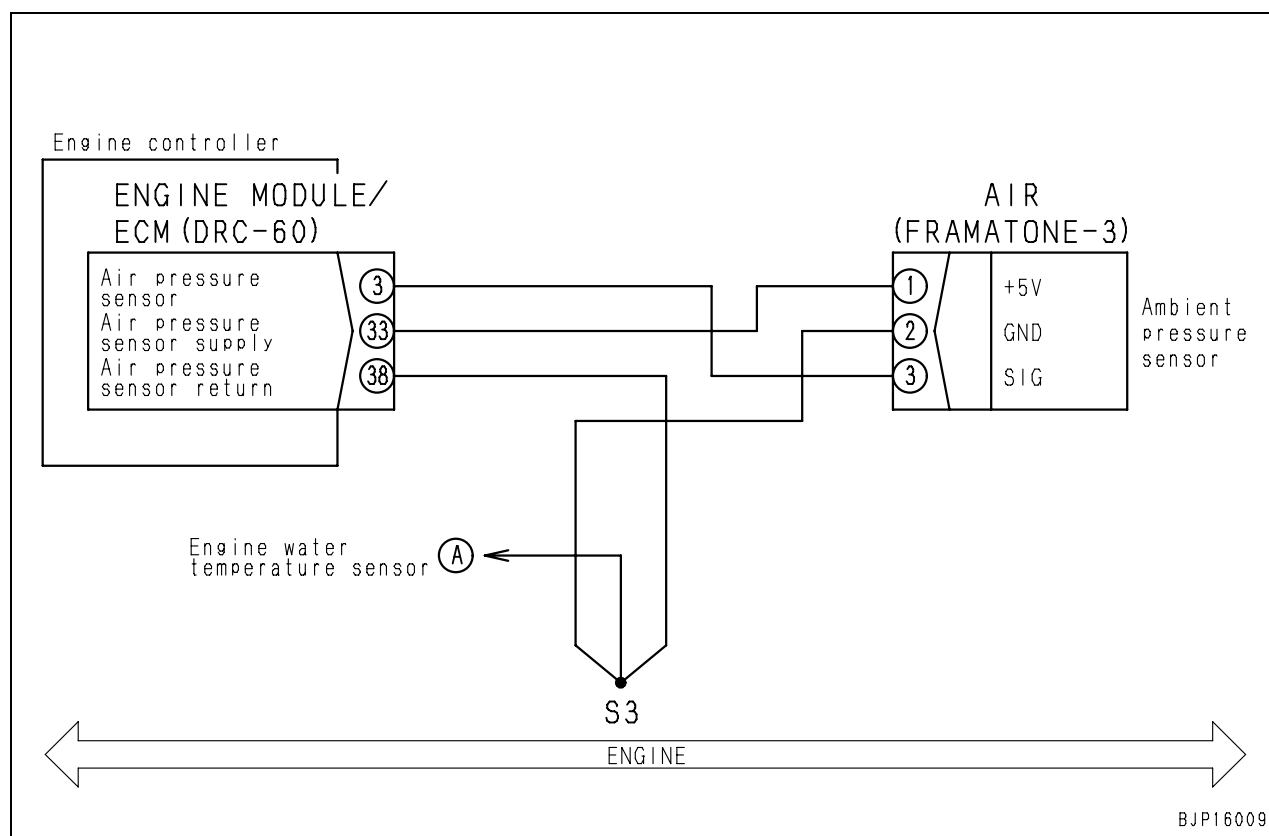


Failure code [CA222] Ambient press sens low error

User code	Failure code	Trouble	Ambient pressure sensor low error (Engine controller system)
E11	CA222		
Contents of trouble	• Low voltage was detected in signal circuit of ambient pressure sensor.		
Action of controller	• Fixes ambient pressure value and continues operation.		
Problem that appears on machine	• Engine does not start easily. • Engine output lowers.		
Related information	• Signal voltage of ambient pressure sensor can be checked with monitoring function. (Code 37401 : Ambient pressure sensor voltage) • Method of reproducing failure code: Turn starting switch ON.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective sensor power supply 1 system	If failure code [CA352] is also indicated, carry out troubleshooting for it first.			
	2	Defective ambient pressure sensor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			AIR		Voltage	
			Between (1) – (2)	Power supply	4.75 – 5.25V	
			Voltage is measured with wiring harness connected. Accordingly, if voltage is abnormal, check wiring harness and controller, too, for another cause of trouble, and then judge.			
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ECM (female) (3) – AIR (female) (3)		Resistance	Min. 100 kΩ
	4	Short circuit in wiring harness (With another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ECM (female) (3) – AIR (female) (3) and between ECM (female) (38) – S3 – AIR (female) (2)		Resistance	Min. 100 kΩ
	5	Defective wiring harness connector	Connecting parts between ambient pressure sensor – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation			
	6	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			ECM		Voltage	
Between (33) – (38)			Voltage	4.75 – 5.25 V		

Circuit diagram related



Failure code [CA227] Sens supply 2 volt high error

User code	Failure code	Trouble	Sensor supply 2 voltage high error (Engine controller system)
E15	CA227		
Contents of trouble	• High voltage was detected in sensor power supply 2 circuit.		
Action of controller	• Fixes boost pressure value and continues operation. • Fixes charge temperature value and continues operation. • Limits output and continues operation.		
Problem that appears on machine	• Engine output lowers.		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

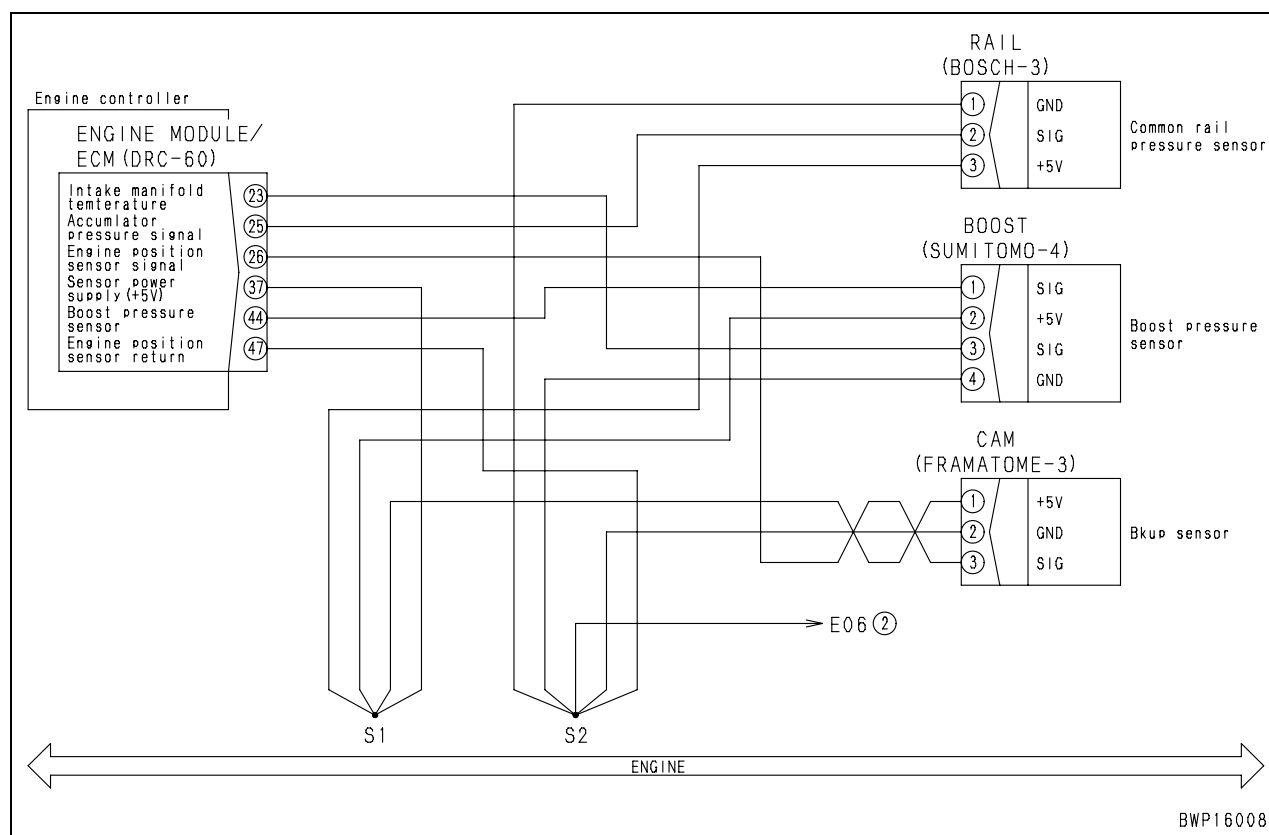
Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective wiring harness connector	
	2	Defective engine controller	

Connecting parts between each sensor – engine wiring harness – engine controller may be defective. Check them directly.

- Looseness of connector, breakage of lock, or breakage of seal
- Corrosion, bend, breakage, push-in, or expansion of pin
- Moisture or dirt in connector or defective insulation

If cause 1 is not detected, engine controller may be defective.
(Since trouble is in system, troubleshooting cannot be carried out.)

Circuit diagram related



Failure code [CA234] Eng. overspeed

User code	Failure code	Trouble	Engine overspeed (Engine controller system)
—	CA234		
Contents of trouble	• Engine speed exceeded control upper speed limit.		
Action of controller	• Stops injection until engine speed lowers to normal level.		
Problem that appears on machine	• Engine speed fluctuates.		
Related information	• Engine speed can be checked with monitoring mode. (Code 01002 : Engine speed) • Method of reproducing failure code: Run engine at high idle.		

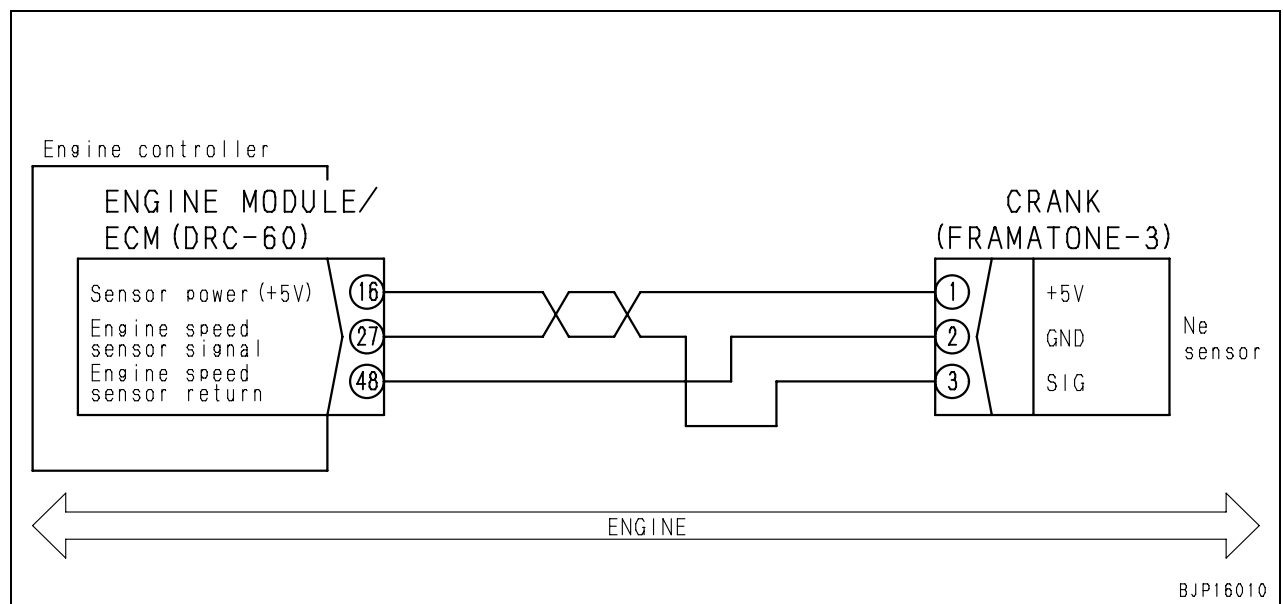
Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Use of improper fuel	Fuel used may be improper. Check it directly.
	2	Improper use	Machine may be used improperly. Teach operator proper using method.
	3	Defective engine controller	If causes 1 – 2 are not detected, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

Failure code [CA238] Ne speed sens supply volt error

User code	Failure code	Trouble	Ne speed sensor supply voltage error (Engine controller system)
E15	CA238		
Contents of trouble	• Low voltage was detected in power supply circuit of engine Ne speed sensor.		
Action of controller	• Continues control with signal from engine Bkup speed sensor.		
Problem that appears on machine	• Engine does not start easily. • Engine hunts.		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting	
	1	Defective sensor or wiring harness	★ Disconnect connector with starting switch OFF, then turn starting switch ON and carry out troubleshooting.	
			Disconnect sensor and wiring harness at right in order and carry out operation to reproduce trouble. If "E" of failure code goes off when sensor or wiring harness is disconnected, that sensor or wiring harness is defective.	
			Ne speed sensor	CRANK
			Engine wiring harness	ECM
	2	Defective wiring harness connector	Connecting parts between each sensor – engine wiring harness – engine controller may be defective. Check them directly. <ul style="list-style-type: none"> Looseness of connector, breakage of lock, or breakage of seal Corrosion, bend, breakage, push-in, or expansion of pin Moisture or dirt in connector or defective insulation 	

Circuit diagram related

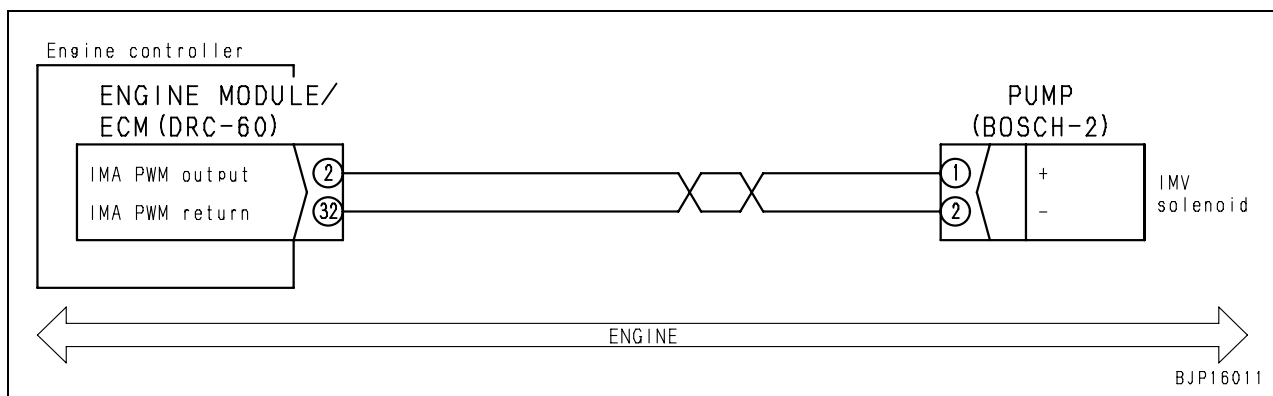


Failure code [CA271] IMV/PCV1 short error

User code	Failure code	Trouble	IMV/PCV1 short error (Engine controller system)
E10	CA271		
Contents of trouble	• Short circuit was detected in drive circuit of supply pump actuator.		
Action of controller	• None in particular.		
Problem that appears on machine	• Engine speed does not rise from low idle. • Engine output lowers. • Common rail fuel pressure rises above command value.		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective supply pump actuator	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			PUMP (male)		Resistance
			Between (1) – chassis ground		Min. 100 kΩ
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ECM (female) (2) – PUMP (female) (1) and chassis ground		Resistance Min. 100 kΩ
	3	Short circuit in wiring harness (With another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Between ECM (female) (2) – each of ECM (female) pins (With all wiring harness connectors disconnected)		Resistance Min. 100 kΩ
	4	Defective wiring harness connector	Connecting parts between supply pump actuator – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation		
	5	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			ECM (female)		Resistance
			Between (2) – chassis ground		Min. 100 kΩ

Circuit diagram related

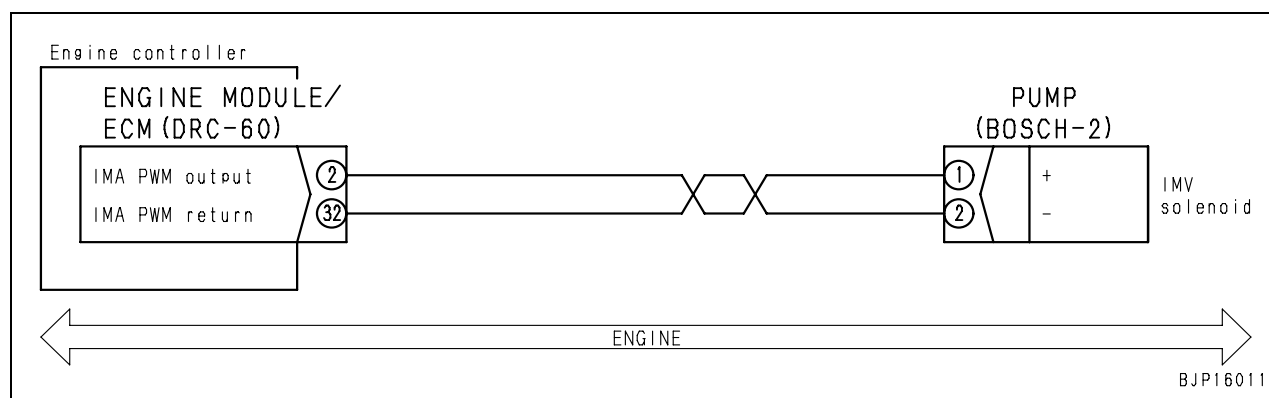


Failure code [CA272] IMV/PCV1 open error

User code	Failure code	Trouble	IMV/PCV1 open error (Engine controller system)
E10	CA272		
Contents of trouble	• Opening was detected in drive circuit of supply pump actuator.		
Action of controller	• None in particular.		
Problem that appears on machine	<ul style="list-style-type: none"> • Engine runs but its operation is unstable. • Common rail fuel pressure rises above command value. 		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective supply pump actuator	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			PUMP (male)		Resistance	
			Between (1) – (2)		Max. 5 Ω	
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ECM (female) (2) – PUMP (female) (1)		Resistance	Max. 10 Ω
			Wiring harness between ECM (female) (32) – PUMP (female) (2)		Resistance	Max. 10 Ω
	3	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between ECM (female) (2) – PUMP (female) (1)		Voltage	Max. 3 V
	4	Short circuit in wiring harness (With another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ECM (female) (2) – each of ECM (female) pins (With all wiring harness connectors disconnected)		Resistance	Min. 100 kΩ
	5	Defective wiring harness connector	Connecting parts between supply pump actuator – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation			
	6	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			ECM (female)		Resistance	
			Between (2) – (32)		Max. 5 Ω	

Circuit diagram related

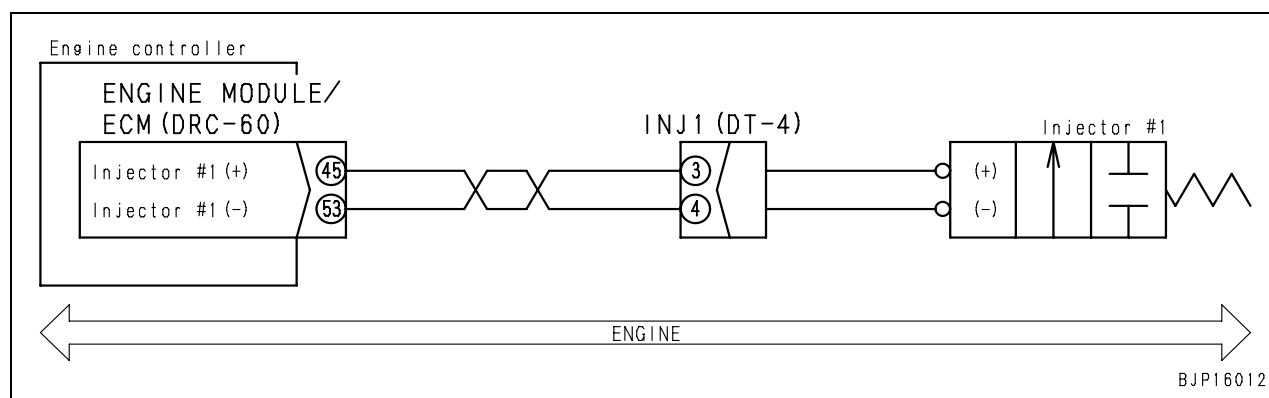


Failure code [CA322] Inj #1 open/short error

User code	Failure code	Trouble	Injector #1 open/short error (Engine controller system)
E11	CA322		
Contents of trouble	• Opening or short circuit was detected in drive circuit of No. 1 injector.		
Action of controller	• None in particular.		
Problem that appears on machine	• Combustion becomes irregular or engine hunts. • Engine output lowers.		
Related information	• Method of reproducing failure code: Start engine.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective No. 1 injector	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			INJ1 (male)		Resistance	
			Between (3) – (4)		Max. 2 Ω	
			Between (3) – chassis ground		Min. 100 kΩ	
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ECM (female) (45) – INJ1 (female) (3)		Resistance	Max. 2 Ω
			Wiring harness between ECM (female) (53) – INJ1 (female) (4)		Resistance	Max. 2 Ω
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ECM (female) (45) – INJ1 (female) (3)		Resistance	Max. 2 Ω
	4	Short circuit in wiring harness (With another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ECM (female) (45) – each of ECM (female) pins (With all wiring harness connectors disconnected)		Resistance	Min. 100 kΩ
			Wiring harness between ECM (female) (53) – each of ECM (female) pins (With all wiring harness connectors disconnected)		Resistance	Min. 100 kΩ
	5	Defective wiring harness connector	Connecting parts between No. 1 injector – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation			
	6	Defective other cylinder injectors or wiring harness	If the failure codes of other injectors are displayed, carry out troubleshooting of them, too.			
	7	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			ECM (female)		Resistance	
			Between (45) – (53)		Max. 2 Ω	
			Between (45) – chassis ground		Min. 100 kΩ	

Circuit diagram related

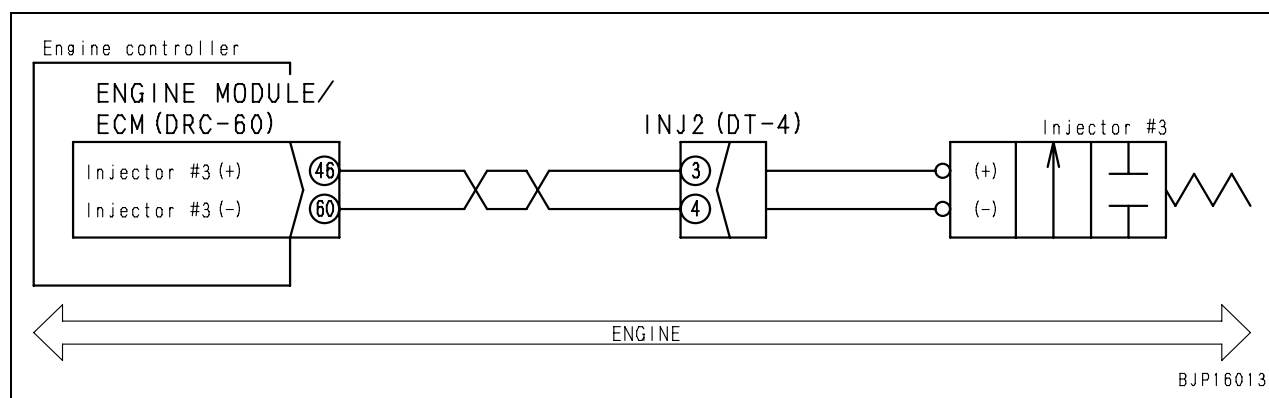


Failure code [CA324] Inj #3 open/short error

User code	Failure code	Trouble	Injector #3 open/short error (Engine controller system)
E11	CA324		
Contents of trouble	• Opening or short circuit was detected in drive circuit of No. 3 injector.		
Action of controller	• None in particular.		
Problem that appears on machine	• Combustion becomes irregular or engine hunts. • Engine output lowers.		
Related information	• Method of reproducing failure code: Start engine.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective No. 3 injector	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			INJ2 (male)		Resistance	
			Between (3) – (4)		Max. 2 Ω	
			Between (3) – chassis ground		Min. 100 kΩ	
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ECM (female) (60) – INJ2 (female) (4)		Resistance	Max. 2 Ω
			Wiring harness between ECM (female) (46) – INJ2 (female) (3)		Resistance	Max. 2 Ω
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ECM (female) (60) – INJ2 (female) (4)		Resistance	Max. 2 Ω
	4	Short circuit in wiring harness (With another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ECM (female) (60) – each of ECM (female) pins (With all wiring harness connectors disconnected)		Resistance	Min. 100 kΩ
			Wiring harness between ECM (female) (46) – each of ECM (female) pins (With all wiring harness connectors disconnected)		Resistance	Min. 100 kΩ
	5	Defective wiring harness connector	Connecting parts between No. 3 injector – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation			
	6	Defective other cylinder injectors or wiring harness	If the failure codes of other injectors are displayed, carry out troubleshooting of them, too.			
	7	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			ECM (female)		Resistance	
			Between (60) – (46)		Max. 2 Ω	
			Between (46) – chassis ground		Min. 100 kΩ	

Circuit diagram related



PC160LC-7E0, PC180LC/NLC-7E0 Hydraulic excavator

Form No. UEN02113-00

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HYDRAULIC EXCAVATOR

PC160LC-7E0

PC180LC-7E0

PC180NLC-7E0

Machine model Serial number

PC160LC-7E0	K45001 and up
PC180LC-7E0	K45001 and up
PC180NLC-7E0	K45001 and up

40 Troubleshooting

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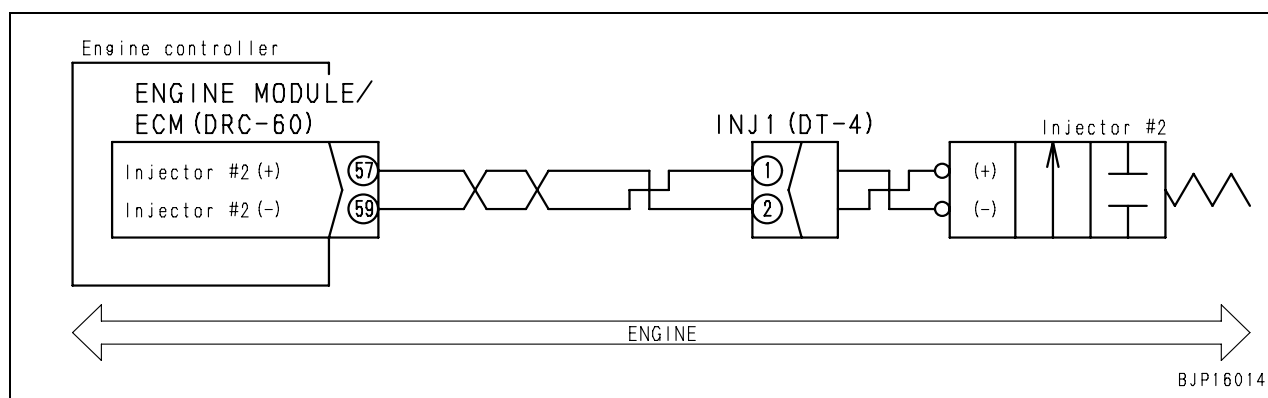
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Failure code [CA2555] Grid htr relay volt high error	50
Failure code [CA2556] Grid htr relay volt low error	52

Failure code [CA331] Inj #2 open/short error

User code	Failure code	Trouble	Injector #2 open/short error (Engine controller system)
E11	CA331		
Contents of trouble	• Opening or short circuit was detected in drive circuit of No. 2 injector.		
Action of controller	• None in particular.		
Problem that appears on machine	• Combustion becomes irregular or engine hunts. • Engine output lowers.		
Related information	• Method of reproducing failure code: Start engine.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective No. 2 injector	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			INJ1 (male)		Resistance	
			Between (1) – (2)		Max. 2 Ω	
			Between (2) – chassis ground		Min. 100 kΩ	
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ECM (female) (59) – INJ1 (female) (1)		Resistance	Max. 2 Ω
			Wiring harness between ECM (female) (57) – INJ1 (female) (2)		Resistance	Max. 2 Ω
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ECM (female) (59) – INJ1 (female) (1)		Resistance	Max. 2 Ω
	4	Short circuit in wiring harness (With another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ECM (female) (59) – each of ECM (female) pins (With all wiring harness connectors disconnected)		Resistance	Min. 100 kΩ
			Wiring harness between ECM (female) (57) – each of ECM (female) pins (With all wiring harness connectors disconnected)		Resistance	Min. 100 kΩ
	5	Defective wiring harness connector	Connecting parts between No. 2 injector – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation			
	6	Defective other cylinder injectors or wiring harness	If the failure codes of other injectors are displayed, carry out troubleshooting of them, too.			
	7	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			ECM (female)		Resistance	
			Between (59) – (57)		Max. 2 Ω	
			Between (57) – chassis ground		Min. 100 kΩ	

Circuit diagram related

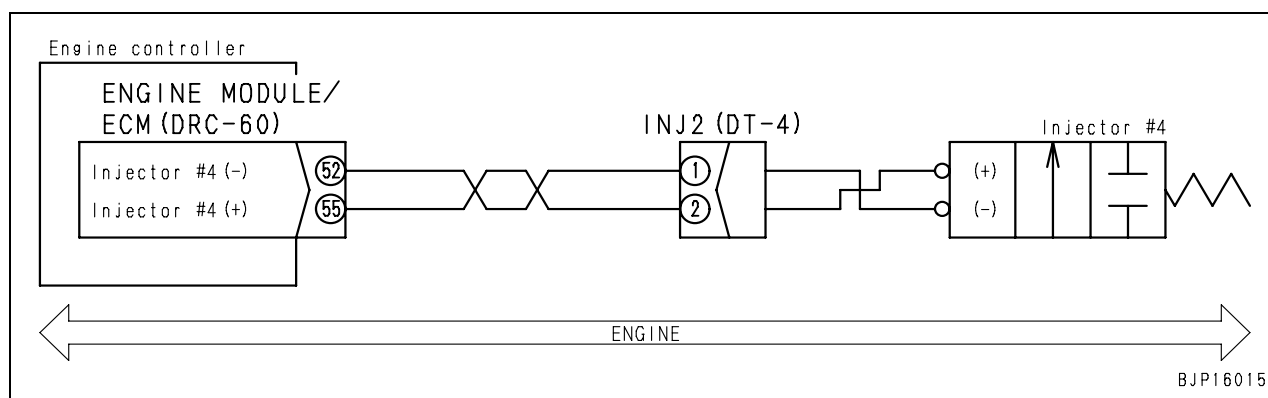


Failure code [CA332] Inj #4 open/short error

User code	Failure code	Trouble	Injector #4 open/short error (Engine controller system)
E11	CA332		
Contents of trouble	• Opening or short circuit was detected in drive circuit of No. 4 injector.		
Action of controller	• None in particular.		
Problem that appears on machine	• Combustion becomes irregular or engine hunts. • Engine output lowers.		
Related information	• Method of reproducing failure code: Start engine.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective No. 4 injector	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			INJ2 (male)		Resistance	
			Between (1) – (2)		Max. 2 Ω	
			Between (2) – chassis ground		Min. 100 kΩ	
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ECM (female) (52) – INJ2 (female) (1)		Resistance	Max. 2 Ω
			Wiring harness between ECM (female) (55) – INJ2 (female) (2)		Resistance	Max. 2 Ω
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ECM (female) (52) – INJ2 (female) (1)		Resistance	Max. 2 Ω
	4	Short circuit in wiring harness (With another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ECM (female) (52) – each of ECM (female) pins (With all wiring harness connectors disconnected)		Resistance	Min. 100 kΩ
			Wiring harness between ECM (female) (55) – each of ECM (female) pins (With all wiring harness connectors disconnected)		Resistance	Min. 100 kΩ
	5	Defective wiring harness connector	Connecting parts between No. 4 injector – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation			
	6	Defective other cylinder injectors or wiring harness	If the failure codes of other injectors are displayed, carry out troubleshooting of them, too.			
	7	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			ECM (female)		Resistance	
			Between (52) – (55)		Max. 2 Ω	
			Between (55) – chassis ground		Min. 100 kΩ	

Circuit diagram related



Failure code [CA342] Calibration code incompatibility

User code	Failure code	Trouble	Calibration code incompatibility (Engine controller system)
E10	CA342		
Contents of trouble	• Incompatibility of data occurred in engine controller.		
Action of controller	• None in particular.		
Problem that appears on machine	• Continues normal operation. • Engine stops or does not start.		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

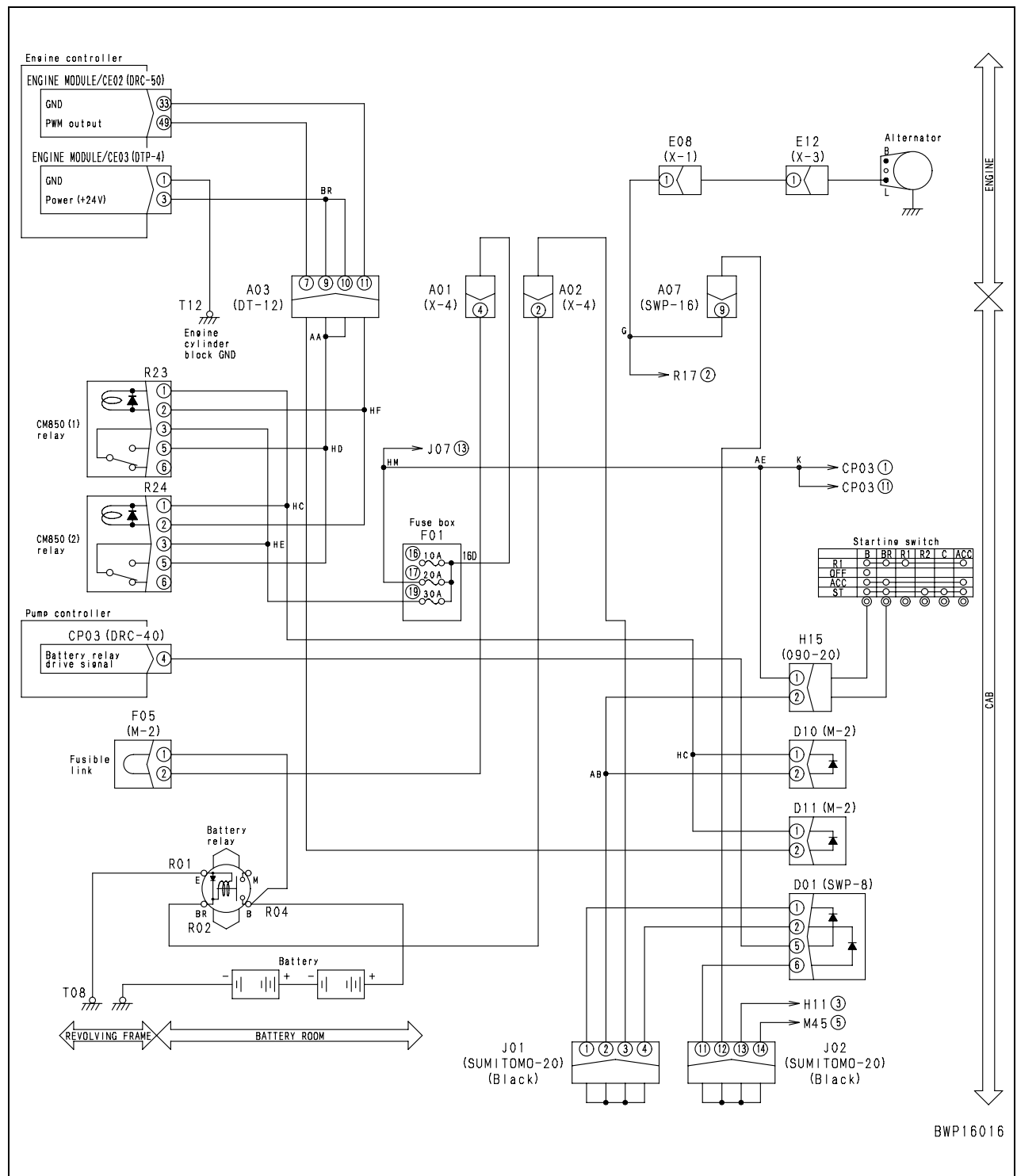
Possible causes and standard value in normal state	Cause	Standard value in normal state/Remarks on troubleshooting
	Carry out troubleshooting for failure code [CA757].	

Failure code [CA351] Injectors drive circuit error

User code	Failure code	Trouble	Injectors drive circuit error (Engine controller system)
E10	CA351		
Contents of trouble	• There is error in drive power circuit of injector.		
Action of controller	• Limits output and continues operation.		
Problem that appears on machine	• Exhaust gas becomes black. • Combustion becomes irregular. • Engine output lowers. • Engine cannot be started.		
Related information	• Method of reproducing failure code: Start engine.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defect in related system	If another failure code is displayed, carry out troubleshooting for it.		
	2	Defective fuse No. 19	If fuse is broken, circuit probably has ground fault.		
	3	Defective relay for engine controller power supply	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Replace relay (R23, R24) for engine controller with another relay and perform reproducing operation. If "E" of failure code goes off at this time, replaced relay is defective.		
	4	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between F01(19) – R23, R24 (female) (3)	Resistance	Max. 0.5 Ω
			Wiring harness between R23, R24 (female) (5) – CE03 (female) (3)	Resistance	Max. 0.5 Ω
	5	Defective engine controller	Wiring harness between CE03 (female) (1) – chassis ground (T12)	Resistance	Max. 10 Ω
			If causes 1 – 4 are not detected, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

Circuit diagram related

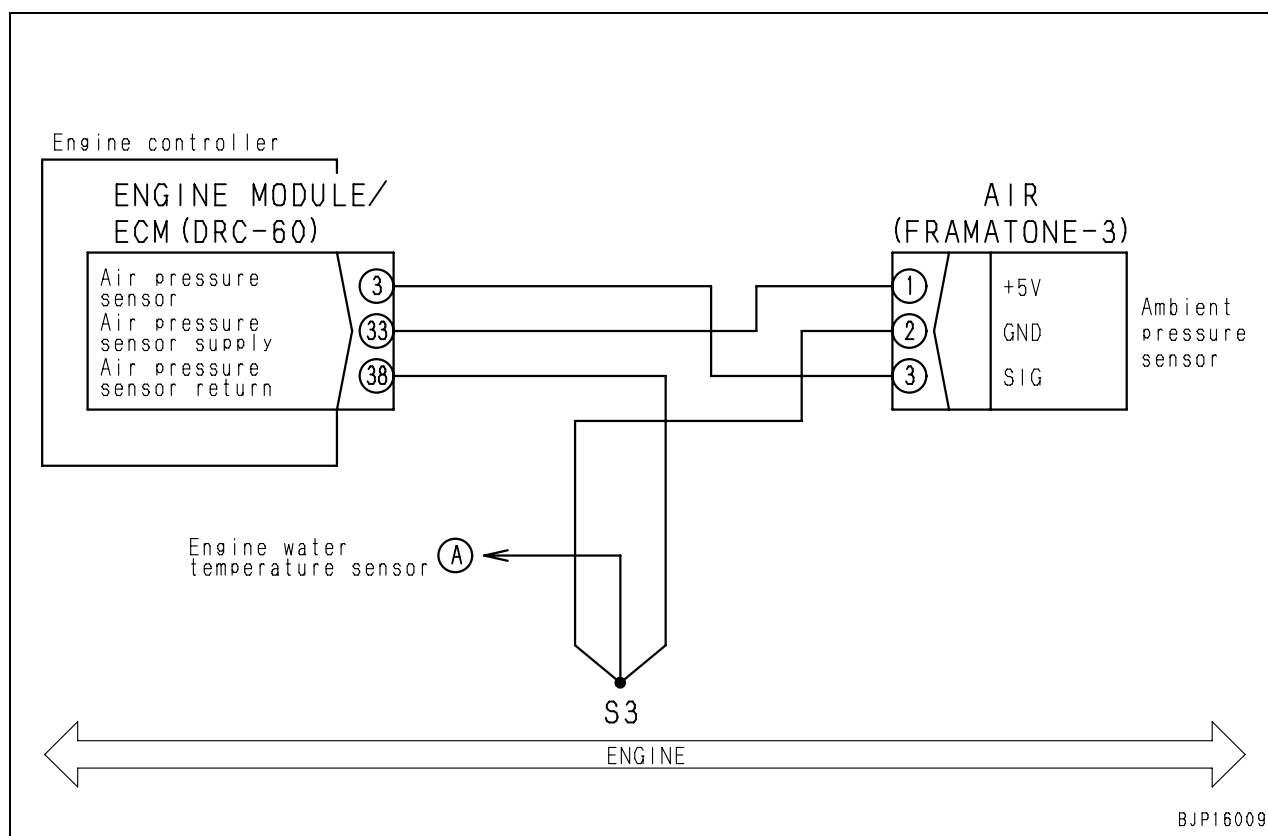


Failure code [CA352] Sens supply 1 volt low error

User code	Failure code	Trouble	Sensor supply 1 voltage low error (Engine controller system)
E15	CA352		
Contents of trouble	• Low voltage was detected in sensor power supply 1 circuit.		
Action of controller	• Fixes ambient pressure value and continues operation.		
Problem that appears on machine	• Engine does not start easily. • Engine output lowers.		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective sensor or wiring harness	★ Disconnect connector with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Disconnect sensor and wiring harness at right in order and carry out operation to reproduce trouble. If "E" of failure code goes off when sensor or wiring harness is disconnected, that sensor or wiring harness is defective.	Ambient pressure sensor	AIR
				Engine wiring harness	ECM
	2	Defective wiring harness connector	Connecting parts between ambient pressure sensor – engine wiring harness – engine controller may be defective. Check them directly. <ul style="list-style-type: none"> Looseness of connector, breakage of lock, or breakage of seal Corrosion, bend, breakage, push-in, or expansion of pin Moisture or dirt in connector or defective insulation 		
	3	Defective engine controller	If causes 1 – 2 are not detected, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

Circuit diagram related

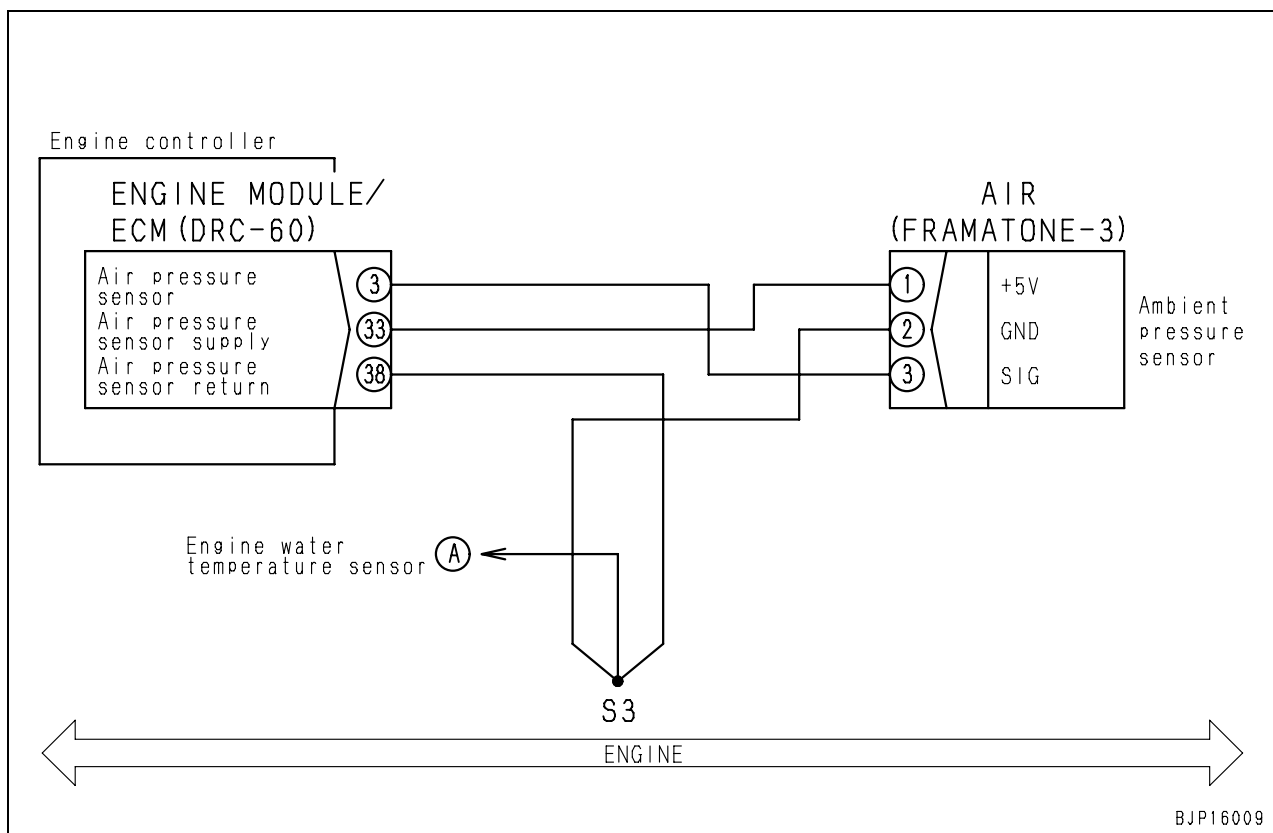


Failure code [CA386] Sens supply 1 volt high error

User code	Failure code	Trouble	Sensor supply 1 voltage high error (Engine controller system)
E15	CA386		
Contents of trouble	<ul style="list-style-type: none"> High voltage was detected in sensor power supply 1 circuit. 		
Action of controller	<ul style="list-style-type: none"> Fixes ambient pressure value and continues operation. 		
Problem that appears on machine	<ul style="list-style-type: none"> Engine does not start easily. Engine output lowers. 		
Related information	<ul style="list-style-type: none"> Method of reproducing failure code: Turn starting switch ON. 		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective wiring harness connector	Connecting parts between ambient pressure sensor – engine wiring harness – engine controller may be defective. Check them directly. <ul style="list-style-type: none"> Looseness of connector, breakage of lock, or breakage of seal Corrosion, bend, breakage, push-in, or expansion of pin Moisture or dirt in connector or defective insulation
	2	Defective engine controller	If cause 1 is not detected, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

Circuit diagram related

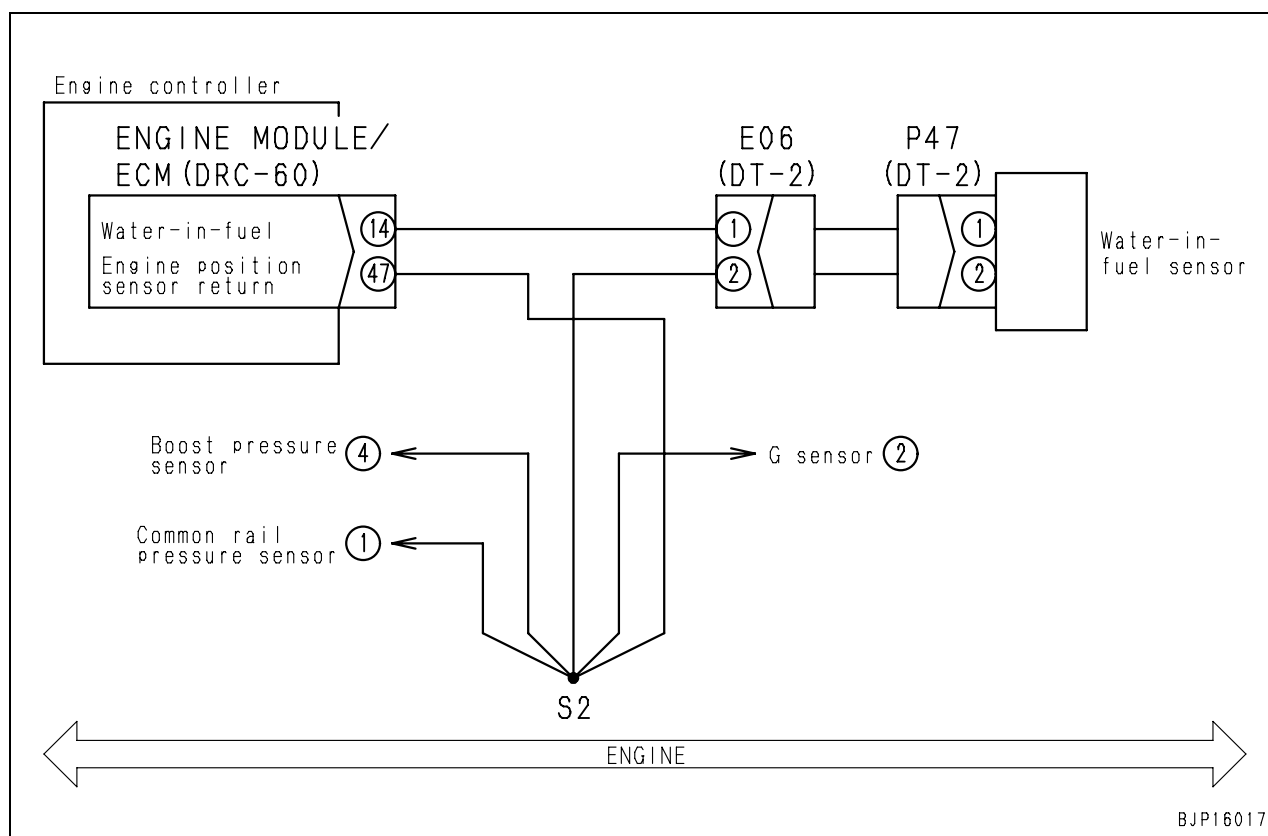


Failure code [CA428] Water in fuel sensor high error

User code	Failure code	Trouble	Water in fuel sensor high error (Engine controller system)
E15	CA428		
Contents of trouble	• High voltage was detected in signal circuit of water in fuel sensor.		
Action of controller	• None in particular.		
Problem that appears on machine	• Water separator monitor does not display normally.		
Related information	• Condition water-in-fuel sensor signal can be checked with monitoring function. (Code 18800 : Condition of WIF sensor) • Method of reproducing failure code: Turn starting switch ON.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective water-in-fuel sensor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			E06 (female)		Resistance
			Between (1) – (2)		10 – 100 kΩ
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ECM (female) (14) – E06 (female) (1)	Resistance	Max. 10 Ω
			Wiring harness between ECM (female) (47) – S2 – E06 (female) (2)	Resistance	Max. 10 Ω
	3	Short circuit in wiring harness (With another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ECM (female) (14) – each of ECM (female) pins (With all wiring harness connectors disconnected)	Resistance	Min. 100 kΩ
	4	Defective wiring harness connector	Connecting parts between water-in-fuel sensor – engine wiring harness – engine controller may be defective. Check them directly. <ul style="list-style-type: none"> Looseness of connector, breakage of lock, or breakage of seal Corrosion, bend, breakage, push-in, or expansion of pin Moisture or dirt in connector or defective insulation 		
	5	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			ECM (female)		Resistance
			Between (14) – (47)		10 – 100 kΩ

Circuit diagram related

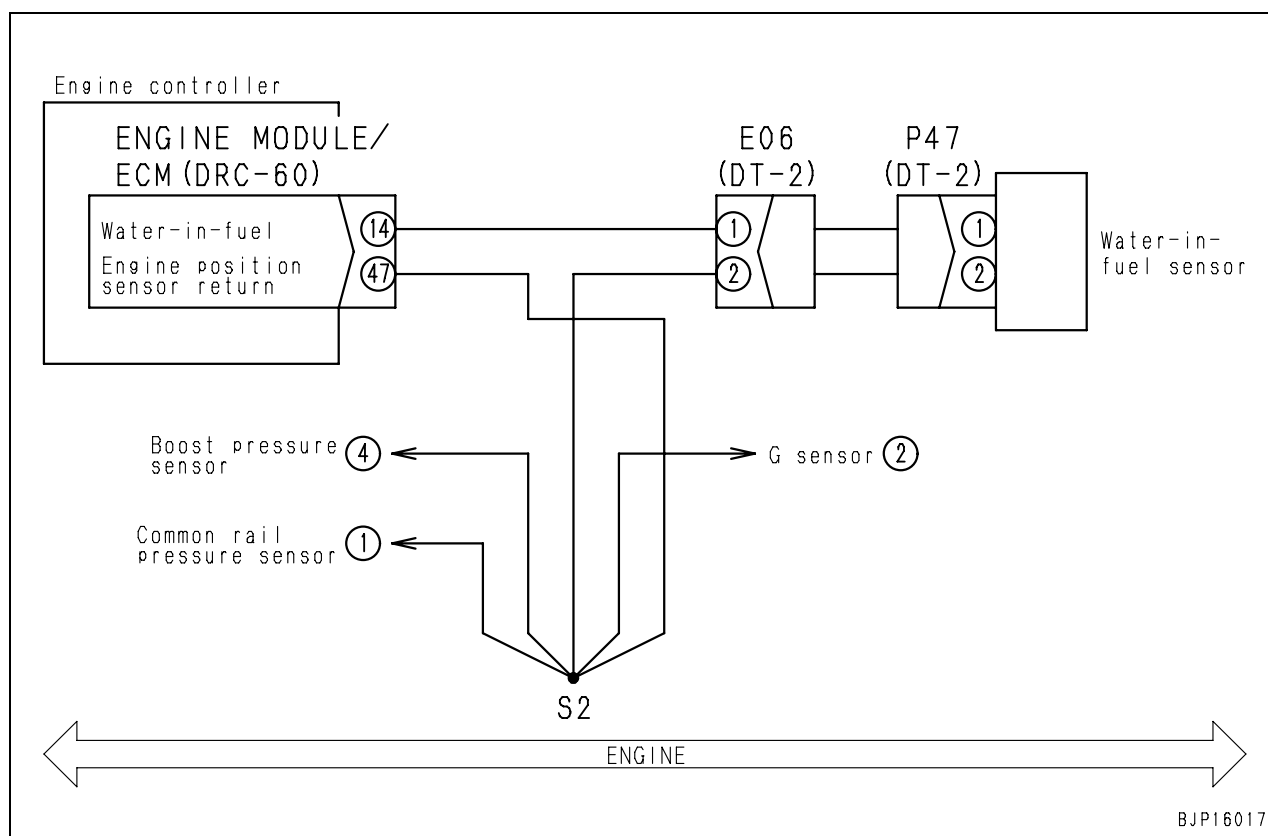


Failure code [CA429] Water in fuel sensor low error

User code	Failure code	Trouble	Water in fuel sensor low error (Engine controller system)
E15	CA429		
Contents of trouble	• Low voltage was detected in signal circuit of water in fuel sensor.		
Action of controller	• None in particular.		
Problem that appears on machine	• Water separator monitor does not display normally.		
Related information	• Condition water-in-fuel sensor signal can be checked with monitoring function. (Code 18800 : Condition of WIF sensor) • Method of reproducing failure code: Turn starting switch ON.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective water-in-fuel sensor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			E06 (female)		Resistance
			Between (1) – (2)		10 – 100 kΩ
			Between (1) – chassis ground		Min. 100 kΩ
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ECM (female) (14) – E06 (female) (1) and chassis ground		Resistance
	3	Short circuit in wiring harness (With another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Between ECM (female) (14) – each of ECM (female) pins (With all wiring harness connectors disconnected)		Resistance
	4	Defective wiring harness connector	Connecting parts between water-in-fuel sensor – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation		
	5	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			ECM (female)		Resistance
			Between (14) – (47)		10 – 100 kΩ
			Between (14) – chassis ground		Min. 100 kΩ

Circuit diagram related

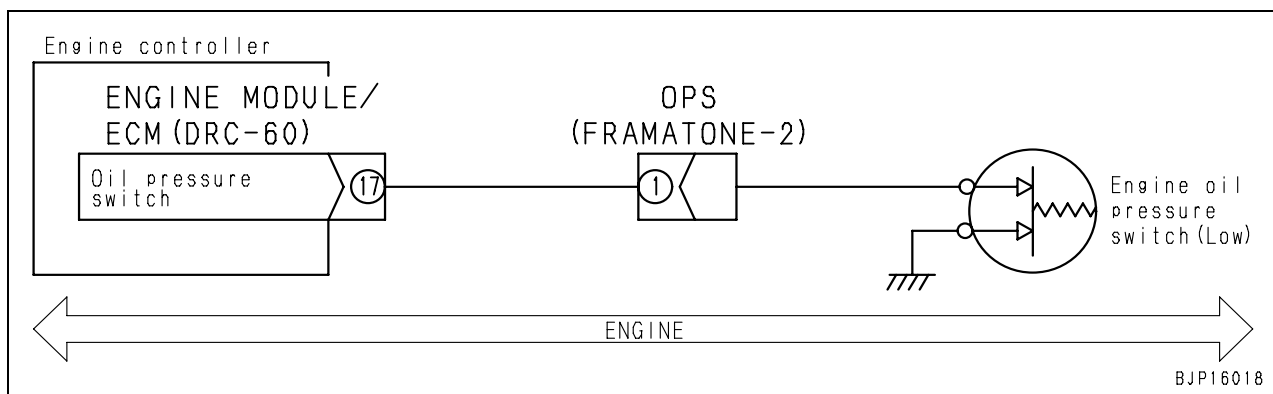


Failure code [CA435] Eng oil press sw error

User code	Failure code	Trouble	Engine oil pressure switch error (Engine controller system)
E15	CA435		
Contents of trouble	• There is error in signal circuit of engine oil pressure switch.		
Action of controller	• None in particular.		
Problem that appears on machine	<ul style="list-style-type: none"> • Engine protection function based on engine oil pressure does not work. • Engine oil pressure monitor does not display normally 		
Related information	• Method of reproducing failure code: Turn starting switch ON or start engine.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective engine oil pressure switch	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			OPS (male)		Resistance
			Between (1) – chassis ground		Max. 10 Ω
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ECM (female) (17) – OPS (female) (1)	Resistance	Max. 10 Ω
	3	Short circuit in wiring harness (With another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ECM (female) (17) – each of ECM (female) pins (With all wiring harness connectors disconnected)	Resistance	Min. 100 kΩ
	4	Defective wiring harness connector	Connecting parts between engine oil pressure switch – engine wiring harness – engine controller may be defective. Check them directly.		
			<ul style="list-style-type: none"> • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation 		
	5	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			ECM (female)		Resistance
			Between (17) – chassis ground		Max. 10 Ω

Circuit diagram related



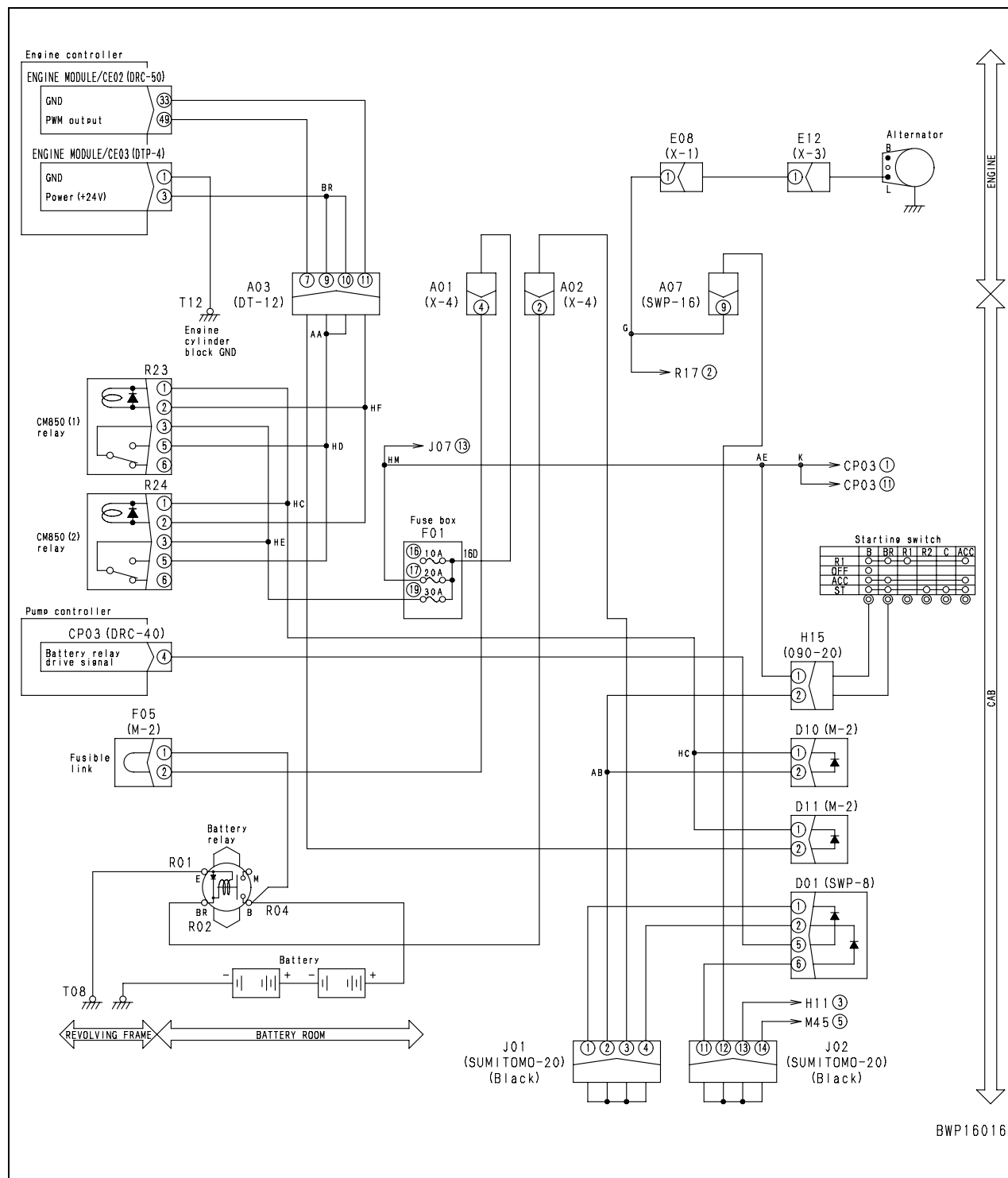
Failure code [CA441] Engine controller battery voltage low error

User code	Failure code	Trouble	Engine controller battery voltage low error (Engine controller system)
E10	CA441		
Contents of trouble	• There is low voltage in controller power supply circuit.		
Action of controller	• None in particular.		
Problem that appears on machine	<ul style="list-style-type: none"> • Engine stops. • Engine does not start easily. 		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Looseness or corrosion of battery terminal	Battery terminal may be loosened or corroded. Check it directly.		
	2	Defective battery voltage	★ Prepare with starting switch OFF, then keep starting switch OFF and turn it to START and carry out troubleshooting in each case.		
			Battery (1 piece)	Starting switch	Voltage
			Between (+) – (–) terminals	OFF	Min. 12 V
				START	Min. 6.2 V
	3	Defective fuse No. 19	If fuse is broken, circuit probably has ground fault. (See Cause 6)		
	4	Defective relay for engine controller power supply	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Replace relay (R23, R24) for engine controller with another relay and perform reproducing operation. If “E” of failure code goes off at this time, replaced relay is defective.		
	5	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between F01(19) – R23, R24 (female) (3)	Resistance	Max. 10 Ω
			Wiring harness between R23, R24 (female) (5) – CE03 (female) (3)	Resistance	Max. 10 Ω
	6	Ground fault in wiring harness (Short circuit with GND circuit)	Wiring harness between CE03 (female) (1) – chassis ground (T12)	Resistance	Max. 10 Ω
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between F01(19) – R23, R24 (female) (3) and chassis ground	Resistance	Min. 100 kΩ
	7	Short circuit in wiring harness (With another wiring harness)	Wiring harness between R23, R24 (female) (5) – CE03 (female) (3) and chassis ground	Resistance	Max. 10 Ω
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Between CE03 (female) (3) – CE03 (female) (1) pins (With battery terminal disconnected)	Resistance	Min. 100 kΩ
	8	Defective wiring harness connector	Between CE03 (female) (3) – each of CE02 (female) pins (With battery terminal disconnected)	Resistance	Min. 100 kΩ
			Between CE03 (female) (1) – each of CE02 (female) pins (With battery terminal disconnected)	Resistance	Min. 100 kΩ
			Connecting parts between fuse No. 19 – machine wiring harness – engine controller may be defective. Check them directly.		
			<ul style="list-style-type: none"> • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation 		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	9	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and start engine and carry out troubleshooting in each case.		
			CE03 (female)	Starting switch	Voltage
			Between (3) – (1)	ON	Min. 24 V
				START	Min. 12 V

Circuit diagram related

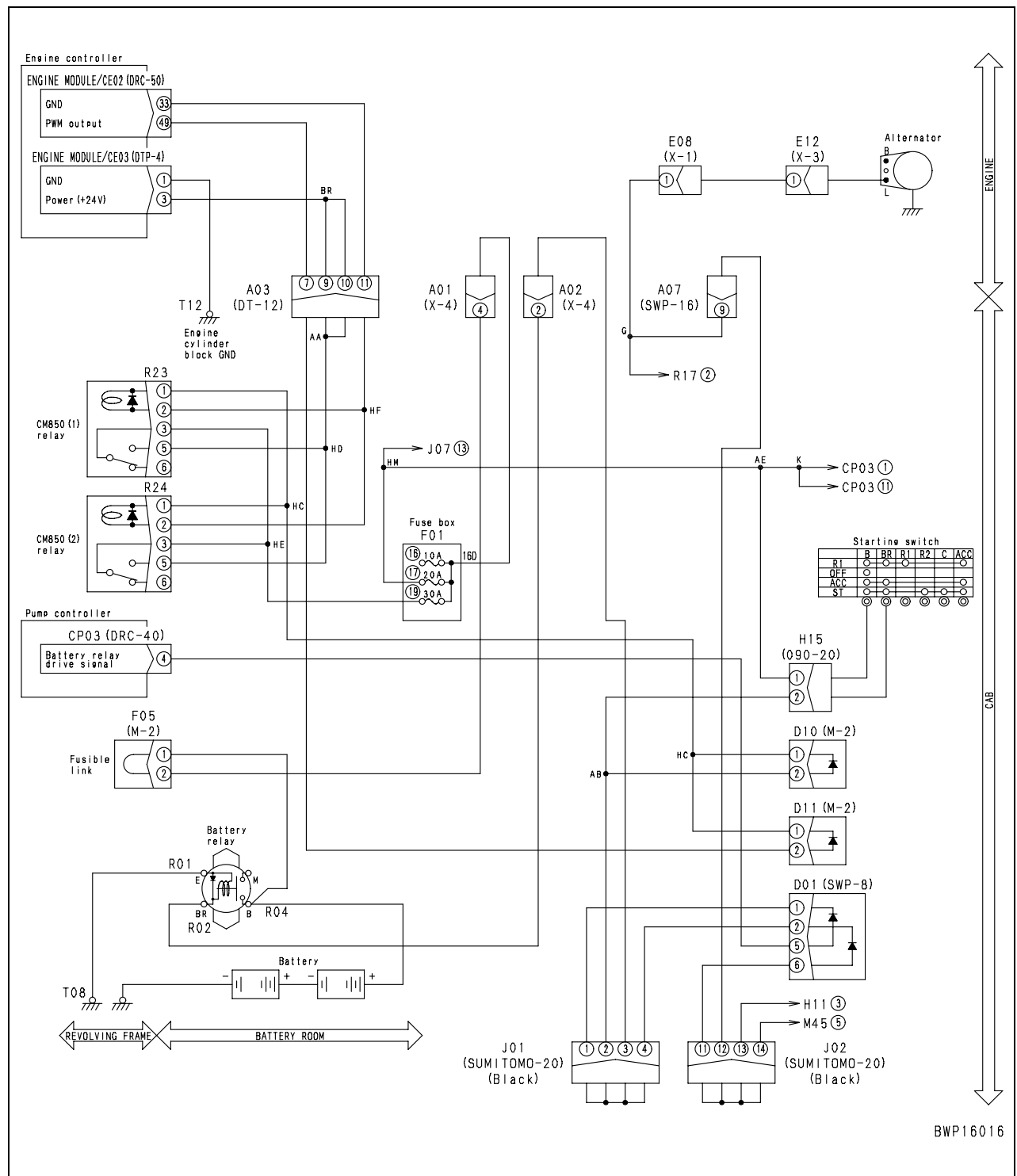


Failure code [CA442] Engine controller battery voltage high error

User code	Failure code	Trouble	Engine controller battery voltage high error (Engine controller system)
E10	CA442		
Contents of trouble	• There is high voltage (36 V or higher) in controller power supply circuit.		
Action of controller	• None in particular.		
Problem that appears on machine	• Engine may stop.		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective battery voltage	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Battery		Voltage
			Between (+) – (–) terminals		Max. 32 V
	2	Defective alternator	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.		
			E12 (male)	Engine speed	Voltage
			Between (1) – chassis ground	Medium or higher	27.5 – 29.5 V
	3	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			CE03 (female)		Voltage
			Between (3) – (1)		Max. 32 V

Circuit diagram related



Failure code [CA449] Rail press very high error

User code	Failure code	Trouble	Rail pressure very high error (Engine controller system)
E11	CA449		
Contents of trouble	• There is high pressure error in common rail circuit.		
Action of controller	• Limits output and continues operation.		
Problem that appears on machine	• Engine sound becomes large when no or light load is applied. • Engine output lowers.		
Related information	• Common rail pressure can be checked with monitoring function. (Code 36400 : Common rail pressure) • Method of reproducing failure code: Start engine.		

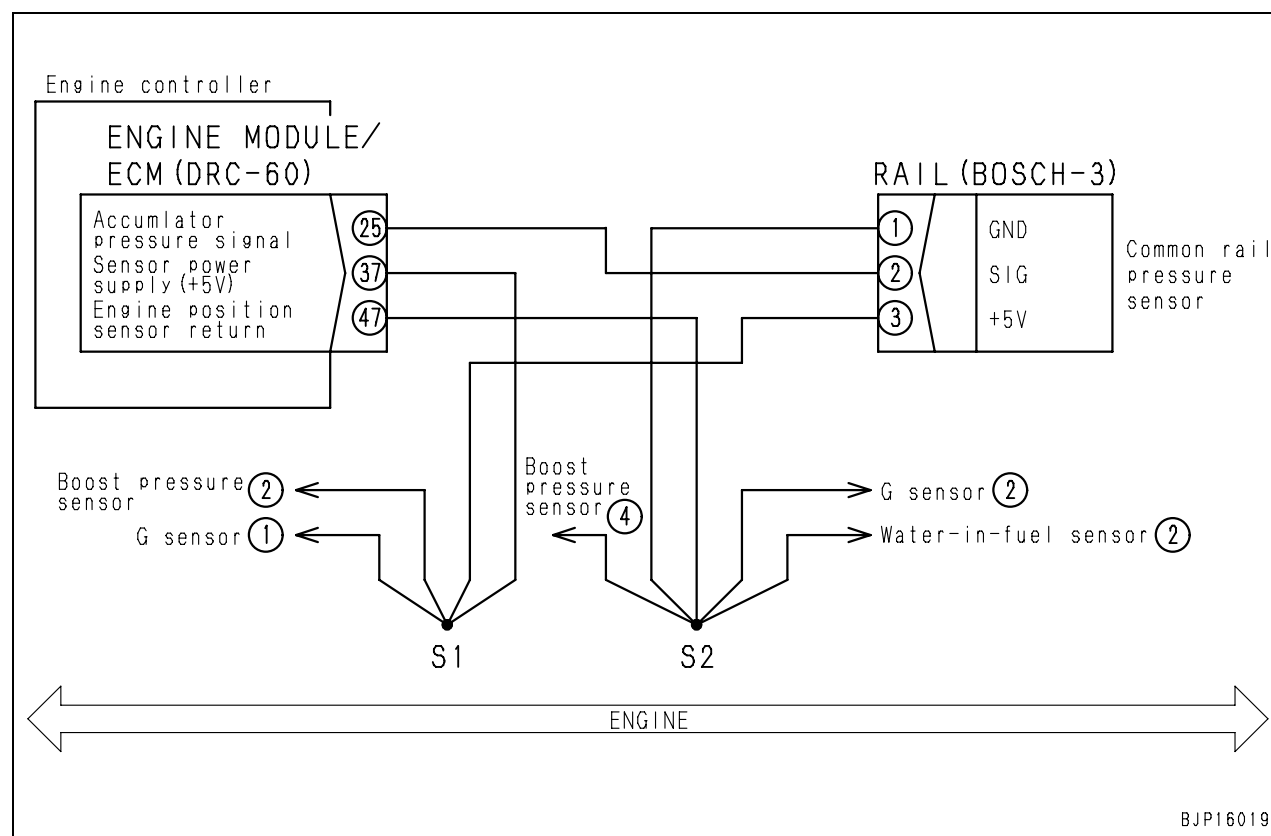
Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defect in related system	If another failure code is displayed, carry out troubleshooting for it.		
	2	Air in low pressure circuit	There may be air in low pressure circuit. Check it directly according to the following procedure. 1) Remove pressure pickup plug (outlet side) of fuel main filter. 2) Operate feed pump of fuel pre-filter. 3) Check pressure pickup plug for leakage of fuel and air.		
	3	Defect in fuel return circuit parts	★ For check of fuel return circuit pressure, see Testing and adjusting, Checking fuel pressure.		
			Fuel return circuit pressure	Low idle running or cranking	Max. 0.02 MPa {Max. 0.19 kg/cm ² }
	4	Defective common rail pressure sensor	★ Prepare with starting switch ON, then keep starting switch ON and carry out troubleshooting in each case.		
			Monitoring code (Machine monitor)		Monitoring information
			36400 Common rail pressure	While engine is stopped	0 ± 0.39 MPa {0 ± 4 kg/cm ² }
	5	Defective pressure limiter	★ For check of leakage through pressure limiter, see Testing and adjusting, Measuring fuel discharge, return and leakage.		
			Leakage through pressure limiter	During low idle	0 cc (No leakage)
	6	Defective supply pump	If causes 1 – 5 are not detected, supply pump may be defective.		

Failure code [CA451] Rail press sensor high error

User code	Failure code	Trouble	Rail pressure sensor high error (Engine controller system)
E11	CA451		
Contents of trouble	<ul style="list-style-type: none"> There is high voltage in signal circuit of common rail pressure sensor. 		
Action of controller	<ul style="list-style-type: none"> Limits output and continues operation. 		
Problem that appears on machine	<ul style="list-style-type: none"> Engine does not start. Engine speed or output lowers. 		
Related information	<ul style="list-style-type: none"> Signal voltage of common rail pressure sensor can be checked with monitoring function. (Code 36401: Common rail pressure sensor voltage) Method of reproducing failure code: Turn starting switch ON. 		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective sensor power supply 2 system	If failure code [CA227] is also displayed, carry out troubleshooting for it first.			
	2	Defective common rail pressure sensor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			RAIL		Voltage	
			Between (3) – (1)	Power supply	4.75 – 5.25 V	
			Voltage is measured with wiring harness connected. Accordingly, if voltage is abnormal, check wiring harness and controller, too, for another cause of trouble, and then judge.			
	3	Hot short (Short circuit with 5V/24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between ECM (female) (25) – RAIL (female) (2)	Voltage	Max. 1 V	
	4	Short circuit in wiring harness (With another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ECM (female) (25) – RAIL (female) (2) and between ECM (female) (37) – S1 – RAIL (female) (3)	Resistance	Min. 100 kΩ	
	5	Defective wiring harness connector	Connecting parts between common rail pressure sensor – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation			
	6	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			ECM		Voltage	
			Between (37) – (47)	Power supply	4.75 – 5.25 V	

Circuit diagram related

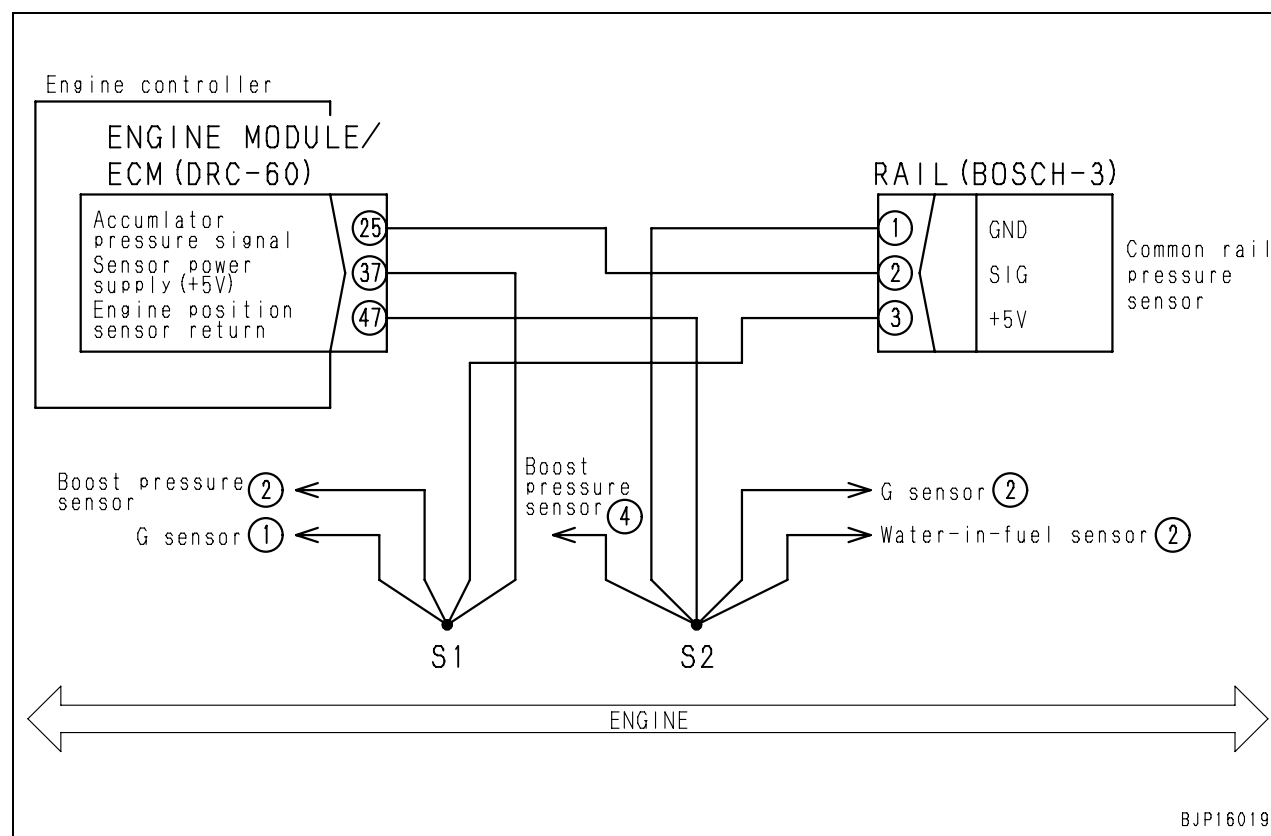


Failure code [CA452] Rail press sensor low error

User code	Failure code	Trouble	Rail pressure sensor low error (Engine controller system)
E11	CA452		
Contents of trouble	<ul style="list-style-type: none"> There is low voltage in signal circuit of common rail pressure sensor. 		
Action of controller	<ul style="list-style-type: none"> Limits output and continues operation. 		
Problem that appears on machine	<ul style="list-style-type: none"> Engine does not start. Engine speed or output lowers. 		
Related information	<ul style="list-style-type: none"> Signal voltage of common rail pressure sensor can be checked with monitoring function. (Code 36401: Common rail pressure sensor voltage) Method of reproducing failure code: Turn starting switch ON. 		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective sensor power supply 2 system	If failure code [CA187] is also displayed, carry out troubleshooting for it first.			
	2	Defective common rail pressure sensor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			RAIL		Voltage	
			Between (3) – (1)	Power supply	4.75 – 5.25 V	
			Voltage is measured with wiring harness connected. Accordingly, if voltage is abnormal, check wiring harness and controller, too, for another cause of trouble, and then judge.			
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between ECM (female) (25) – RAIL (female) (2)		Resistance	Min. 100 kΩ
	4	Short circuit in wiring harness (With another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ECM (female) (25) – RAIL (female) (2) and between ECM (female) (47) – S2 – RAIL (female) (1)		Resistance	Min. 100 kΩ
	5	Defective wiring harness connector	Connecting parts between common rail pressure sensor – engine wiring harness – engine controller may be defective. Check them directly. <ul style="list-style-type: none">Looseness of connector, breakage of lock, or breakage of sealCorrosion, bend, breakage, push-in, or expansion of pinMoisture or dirt in connector or defective insulation			
	6	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			ECM		Voltage	
			Between (37) – (47)	Power supply	4.75 – 5.25 V	

Circuit diagram related



Failure code [CA488] Chg air temp high torque derate

User code	Failure code	Trouble	Charge air temperature high torque derate (Engine controller system)
E11	CA488		
Contents of trouble	• Temperature signal of boost pressure/temperature sensor exceeded control upper temperature limit.		
Action of controller	• Limits output and continues operation.		
Problem that appears on machine	• Engine output lowers.		
Related information	• Boost temperature can be checked with monitoring function. (Code 18500 : Boost temperature) • Method of reproducing failure code: Start engine.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Lowering of cooling performance of aftercooler	Cooling performance of aftercooler may be low. Check following points directly. <ul style="list-style-type: none"> Looseness and breakage of fan belt. Insufficiency of cooling air Clogging of aftercooler fins
	2	Abnormal rise of turbo-charger outlet temperature	Outlet temperature of turbocharger may be abnormally high. Check related parts directly.
	3	Defective engine controller	If causes 1 – 2 are not detected, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)

Failure code [CA553] Rail press high error

User code	Failure code	Trouble	Rail pressure high error (Engine controller system)
E15	CA553		
Contents of trouble	• There is high pressure error in common rail circuit.		
Action of machine monitor	• None in particular.		
Problem that appears on machine	• Engine sound becomes large when no or light load is applied. • Engine output lowers.		
Related information	• Common rail pressure can be checked with monitoring function. (Code 36400 : Common rail pressure) • Method of reproducing failure code: Start engine.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defect in related system	If another failure code is displayed, carry out troubleshooting for it.
	2	Defective connection of ground terminal	Ground terminal may be connected defectively. Check following terminals directly. <ul style="list-style-type: none"> Ground terminal of machine ((-) terminal of battery) Ground terminal of engine Ground terminal of engine controller Ground terminal of starting motor
	3	Breakage of O-ring of supply pump actuator	O-ring of supply pump actuator may be broken. Check it directly.

Failure code [CA559] Rail press low error

User code	Failure code	Trouble	Rail pressure low error (Engine controller system)
E15	CA559		
Contents of trouble	• There is low pressure error in common rail circuit.		
Action of controller	• None in particular.		
Problem that appears on machine	• Engine does not start at all or does not start easily. • Exhaust gas becomes black. • Engine output lowers.		
Related information	• Common rail pressure can be checked with monitoring function. (Code 36400 : Common rail pressure) • Method of reproducing failure code: Start engine.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Fuel leakage to outside	Fuel may be leaking to outside. Check it directly (Check visually while running engine at low idle).		
	2	Defect in low pressure circuit parts	★ For check of pressure in fuel low pressure circuit, see Testing and adjusting, Checking fuel pressure.		
			Pressure in fuel low-pressure circuit	During cranking (if engine cannot be started)	0.3 – 1.1 MPa {3.1 – 11.3 kg/cm ² }
				During low idle (if engine can be started)	0.5 – 1.3 MPa {5.1 – 13.3 kg/cm ² }
	3	Defective pressure limiter	★ For check of leakage through pressure limiter, see Testing and adjusting, Measuring fuel discharge, return and leakage.		
			Leakage through pressure limiter	During low idle	0 cc (No leakage)
	4	Defective injector (including high pressure piping in head)	★ For check of return rate from injector, see Testing and adjusting, Measuring fuel discharge, return and leakage.		
			Return rate from injector	During cranking (if engine cannot be started)	Max. 90 cc/min.
				During low idle (if engine can be started)	Max. 120 cc/min.
	5	Defective supply pump	★ For check of discharge from supply pump and return rate from supply pump, see Testing and adjusting, Measuring fuel discharge, return and leakage.		
			Discharge from supply pump	Engine speed: 125 rpm	Min. 75cc/30sec.
				Engine speed: 150 rpm	Min. 90cc/30sec.
			Return rate from supply pump	During low idle (750 rpm)	Max. 400cc/25sec.

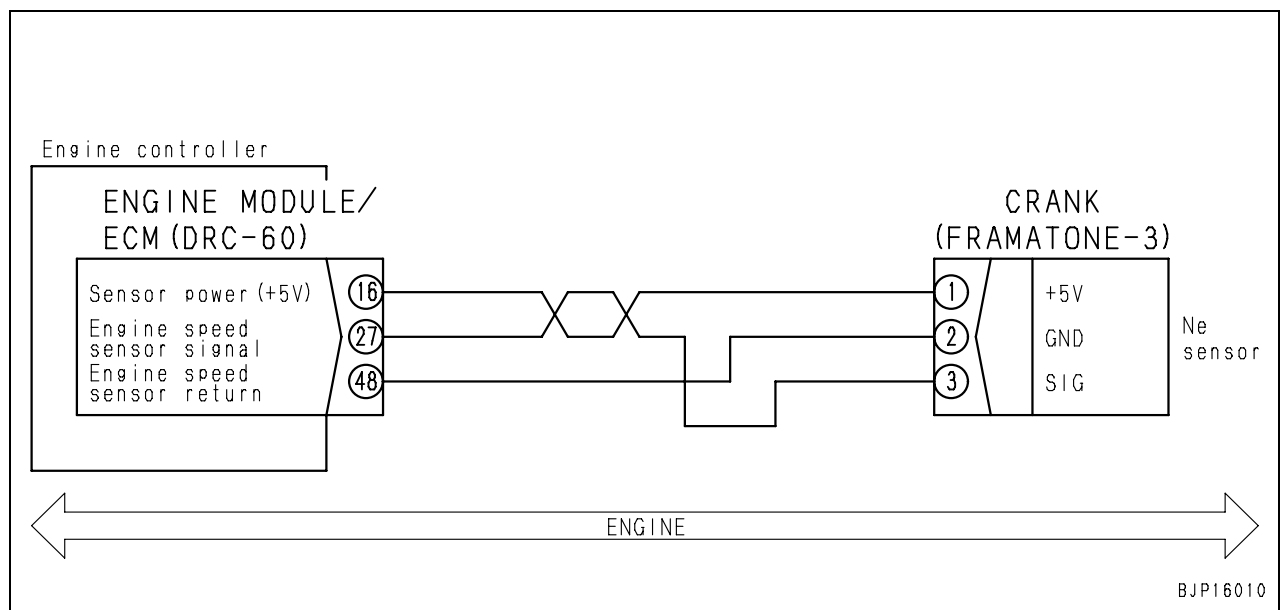
Failure code [CA689] Eng Ne speed sensor error

User code	Failure code	Trouble	Engine Ne speed sensor error (Engine controller system)
E15	CA689		
Contents of trouble	• There is error in signal from engine Ne speed sensor.		
Action of controller	• Continues control with signal from engine Bkup speed sensor.		
Problem that appears on machine	<ul style="list-style-type: none"> • Engine hunts. • Engine does not start easily. • Engine output lowers. 		
Related information	• Method of reproducing failure code: Start engine.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective Ne speed sensor power supply system	If failure code [CA238] is also displayed, carry out troubleshooting for it first.		
	2	Defective engine Ne speed sensor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			CRANK		Voltage
			Between (1) – (2)	Power supply	4.75 – 5.25 V
			Voltage is measured with wiring harness connected. Accordingly, if voltage is abnormal, check wiring harness and controller, too, for another cause of trouble, and then judge.		
	3	Breakage or improper clearance of engine Ne speed sensor	Engine Ne speed sensor may be broken or may have improper clearance. Check it directly.		
	4	Breakage of rotation sensor wheel	Rotation sensor wheel may be broken. Check it directly.		
	5	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ECM (female) (27) – CRANK (female) (3)	Resistance	Max. 10 Ω
	6	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ECM (female) (27) – CRANK (female) (3)	Resistance	Min. 100 kΩ
	7	Hot short (Short circuit with 5V/24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between ECM (female) (27) – CRANK (female) (3)	Voltage	Max. 1 V
	8	Short circuit in wiring harness (With another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ECM (female) (27) – CRANK (female) (3) or between ECM (female) (16) – CRANK (female) (1)	Resistance	Min. 100 kΩ
			Wiring harness between ECM (female) (27) – CRANK (female) (3) or between ECM (female) (48) – CRANK (female) (2)	Resistance	Min. 100 kΩ

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	9	Defective wiring harness connector	Connecting parts between engine Ne speed sensor – engine wiring harness – engine controller may be defective. Check them directly. <ul style="list-style-type: none"> Looseness of connector, breakage of lock, or breakage of seal Corrosion, bend, breakage, push-in, or expansion of pin Moisture or dirt in connector or defective insulation 		
	10	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			ECM		Voltage
			Between (16) – (48)	Power supply	4.75 – 5.25 V

Circuit diagram related



Failure code [CA731] Eng Bkup speed sens phase error

User code	Failure code	Trouble	Engine Bkup speed sensor phase error (Engine controller system)
E15	CA731		
Contents of trouble	• Phase error was detected in signals from engine Ne speed sensor and engine Bkup speed sensor		
Action of controller	• Continues control with signal from engine Ne speed sensor.		
Problem that appears on machine	• Engine does not start at all or does not start easily. • Idle speed is unstable. • Exhaust gas becomes black.		
Related information	• Method of reproducing failure code: Start engine.		

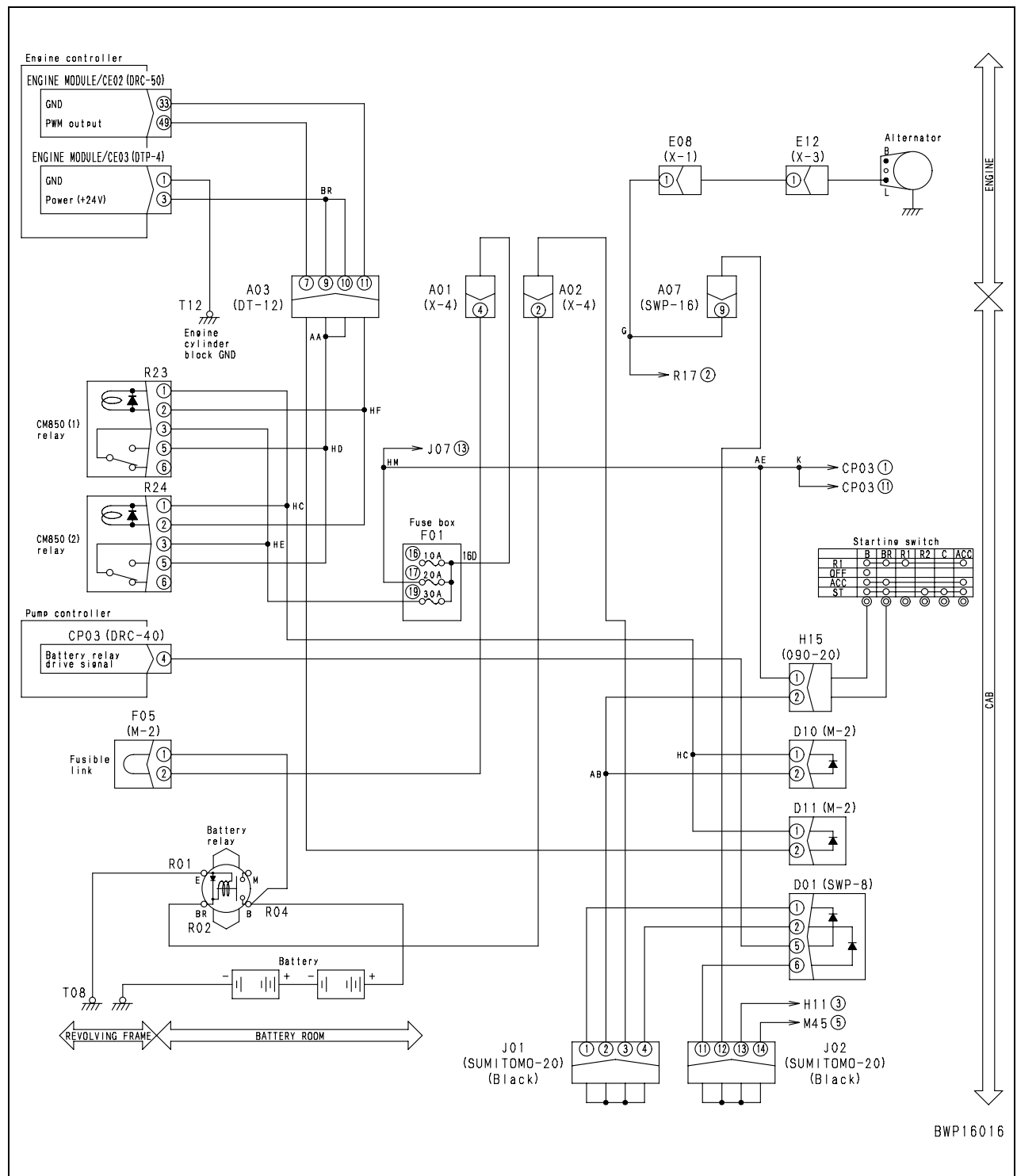
Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Breakage of engine Ne speed sensor	Engine Ne speed sensor may be broken. Check it directly.
	2	Breakage of engine Bkup speed sensor	Engine Bkup speed sensor may be broken. Check it directly.
	3	Defective installation or breakage of rotation sensor wheel on crankshaft side	Rotation sensor wheel on crankshaft side may be installed defectively or broken. Check it according to the following procedure. 1) Set No. 1 cylinder at compression top dead centre (Match stamped mark). 2) If centre of oblong hole of rotation sensor wheel is at tip of Ne speed sensor, rotation sensor wheel is installed normally.
	4	Defective installation or breakage of rotation sensor ring on camshaft side	Rotation sensor ring on camshaft side may be installed defectively or broken. Check it according to the following procedure. 1) Set No. 1 cylinder at compression top dead centre (Match stamped mark). 2) Remove Bkup speed sensor. 3) If 2 grooves (1 crest) of rotation sensor ring are seen through sensor mounting hole, rotation sensor ring is installed normally.
	5	Defective timing of crankshaft and camshaft	Timing of crankshaft and camshaft may be defective. Check it directly.
	6	Defective connection of ground terminal	Ground terminal may be connected defectively. Check following terminals directly. <ul style="list-style-type: none"> Ground terminal of machine ((-) terminal of battery) Ground terminal of engine Ground terminal of engine controller Ground terminal of starting motor

Failure code [CA757] All continuous data lost error

User code	Failure code	Trouble	All continuous data lost error (Engine controller system)
E10	CA757		
Contents of trouble	• All data in engine controller are lost.		
Action of controller	• None in particular.		
Problem that appears on machine	• Engine may stop and may not be started again. • Monitoring function of machine monitor (engine controller system) may not work normally.		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defect in related system	If another failure code is displayed, carry out troubleshooting for it.		
	2	Looseness or corrosion of battery terminal	Battery terminal may be loosened or corroded. Check it directly.		
	3	Low battery voltage	★ Prepare with starting switch OFF, then keep starting switch OFF and start engine and carry out troubleshooting in each case.		
			Battery (1 piece)	Starting switch	Voltage
			Between (+) – (–) terminals	OFF	Min. 12 V
				START	Min. 6.2 V
	4	Defective fuse No. 19	If fuse is broken, circuit probably has ground fault.		
	5	Defective relay for engine controller power supply	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Replace relay (R23, R24) for engine controller with another relay and perform reproducing operation. If "E" of failure code goes off at this time, replaced relay is defective.		
	6	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between F01(19) – R23, R24 (female) (3)	Resistance	Max. 10 Ω
			Wiring harness between R23, R24 (female) (5) – CE03 (female) (3)	Resistance	Max. 10 Ω
	7	Defective wiring harness connector	Connecting parts between fuse No. 19 – machine wiring harness – engine controller may be defective. Check them directly.		
			<ul style="list-style-type: none"> Looseness of connector, breakage of lock, or breakage of seal Corrosion, bend, breakage, push-in, or expansion of pin Moisture or dirt in connector or defective insulation 		
	8	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and start engine and carry out troubleshooting in each case.		
			CE03 (female)	Starting switch	Voltage
			Between (3) – (1)	ON	Min. 24 V
				START	Min. 12 V

Circuit diagram related



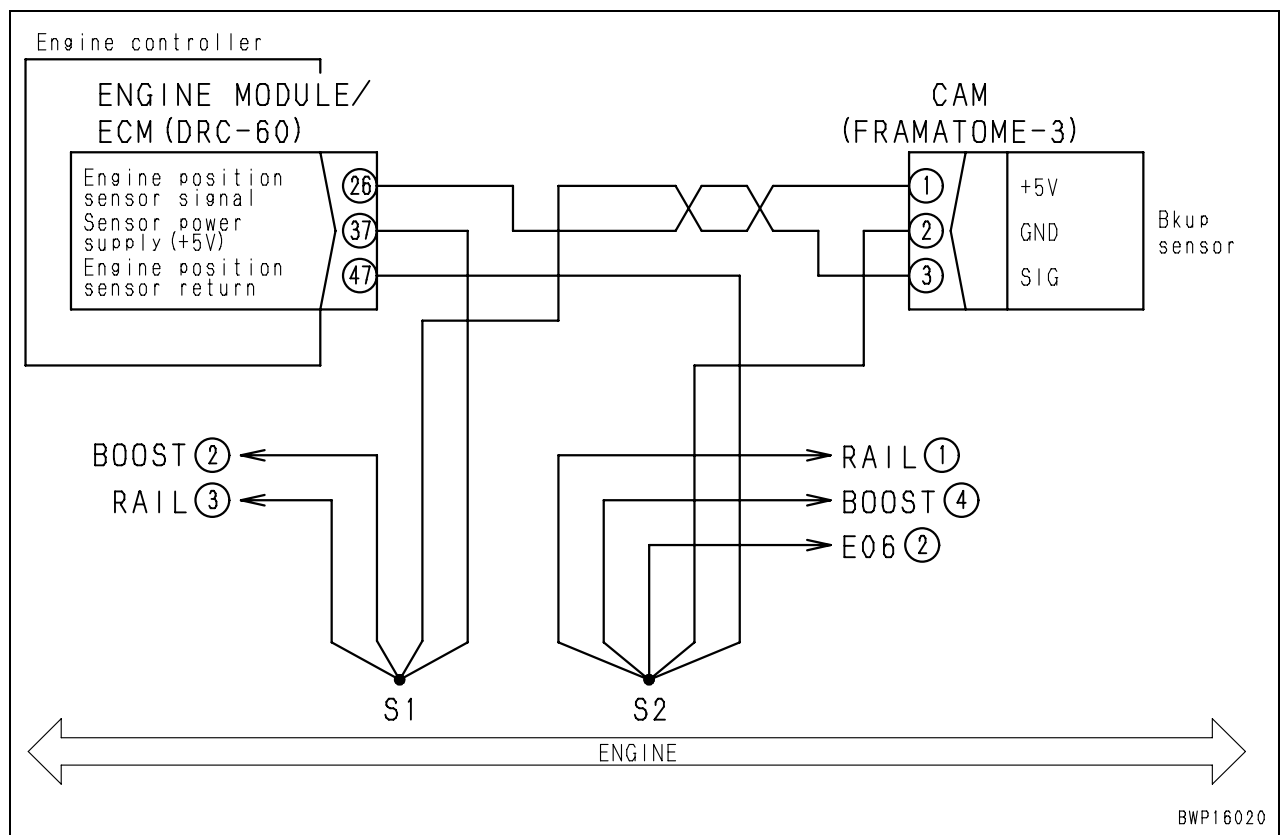
Failure code [CA778] Eng Bkup speed sensor error

User code	Failure code	Trouble	Engine Bkup speed sensor error (Engine controller system)
E15	CA778		
Contents of trouble	• There is error in signal from engine Bkup speed sensor.		
Action of controller	• Continues control with signal from engine Ne speed sensor.		
Problem that appears on machine	• Engine does not start easily. • Engine output lowers.		
Related information	• Method of reproducing failure code: Start engine.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective sensor power supply 2 system	If failure code [CA187] is also displayed, carry out troubleshooting for it first.			
	2	Defective engine Bkup speed sensor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			CAM		Voltage	
			Between (1) – (2)	Power supply	4.75 – 5.25 V	
			Voltage is measured with wiring harness connected. Accordingly, if voltage is abnormal, check wiring harness and controller, too, for another cause of trouble, and then judge.			
	3	Breakage or improper clearance of engine Bkup speed sensor	Engine Bkup speed sensor may be broken or may have improper clearance. Check it directly.			
	4	Breakage of rotation sensor ring	Rotation sensor ring may be broken. Check it directly.			
	5	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ECM (female) (26) – CAM (female) (3)		Resistance	Max. 10 Ω
	6	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ECM (female) (26) – CAM (female) (3)		Resistance	Min. 100 kΩ
	7	Hot short (Short circuit with 5V/24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between ECM (female) (26) – CAM (female) (3)		Voltage	Max. 1 V
	8	Short circuit in wiring harness (With another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between ECM (female) (26) – CAM (female) (3) or between ECM (female) (37) – S1 – CAM (female) (1)		Resistance	Min. 100 kΩ
			Wiring harness between ECM (female) (26) – CAM (female) (3) or between ECM (female) (47) – S2 – CAM (female) (2)		Resistance	Min. 100 kΩ

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	9	Defective wiring harness connector	Connecting parts between engine Bkup speed sensor – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation		
	10	Defective engine controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			ECM		Voltage
			Between (37) – (47)	Power supply	4.75 – 5.25 V

Circuit diagram related

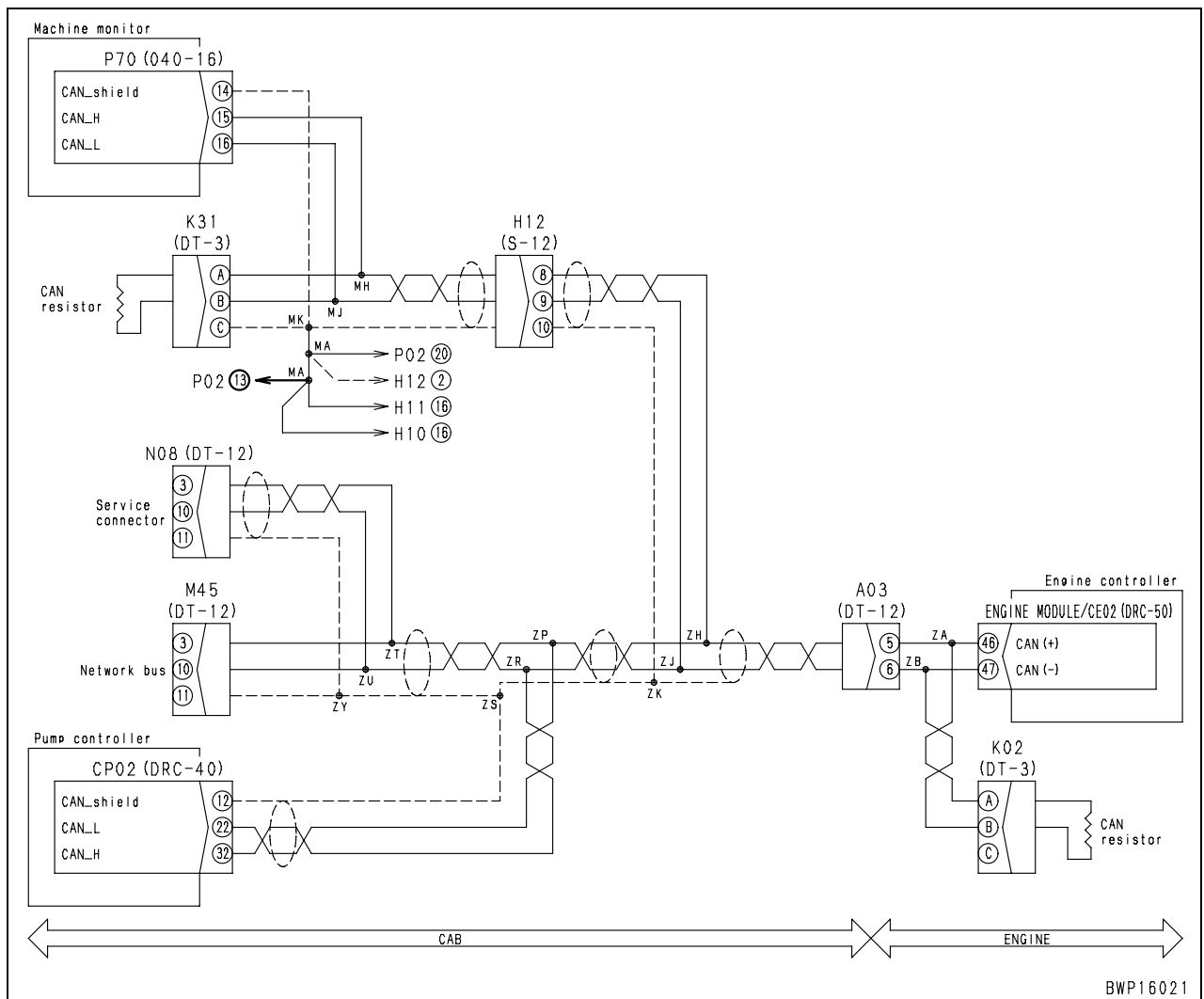


Failure code [CA1633] KOMNET Datalink timeout error

User code	Failure code	Trouble	KOMNET Datalink timeout error (Engine controller system)
E0E	CA1633		
Contents of trouble	• Engine controller detected communication error in KOMNET communication circuit between pump controller and machine monitor.		
Action of controller	• Continues operation in default mode. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Information may not transmitted normally by KOMNET communication and machine may not operate normally. (Trouble phenomenon depends on failed section.)		
Related information	• Method of reproducing failure code: Turn starting switch ON.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between P70 (female) (15) – CP02 (female) (32), – CE02 (female) (46), – K02 (female) (A)	Resistance	Max. 1 Ω
			Wiring harness between P70 (female) (16) – CP02 (female) (22), – CE02 (female) (47), – K02 (female) (B)	Resistance	Max. 1 Ω
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between P70 (female) (15) – CP02 (female) (32), – CE02 (female) (46), – K02 (female) (A), – N08 (male) (3)	Resistance	Min. 1 MΩ
			Wiring harness between CP70 (female) (16) – CP02 (female) (22), – CE02 (female) (47), – K02 (female) (B), – N08 (male) (10)	Resistance	Min. 1 MΩ
	3	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between P70 (female) (15) – CP02 (female) (32), – CE02 (female) (46), – K02 (female) (A), – N08 (male) (3)	Voltage	Max. 5.5 V
			Wiring harness between P70 (female) (16) – CP02 (female) (22), – CE02 (female) (47), – K02 (female) (B), – N08 (male) (10)	Voltage	Max. 5.5 V
	4	Defective CAN terminal resistance (Internal short circuit or disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			K02 (male)	Resistance	
			Between (A) – (B)	120 ± 12 Ω	
	5	Defective pump controller	If causes 1 – 4 are not detected, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

Circuit diagram related

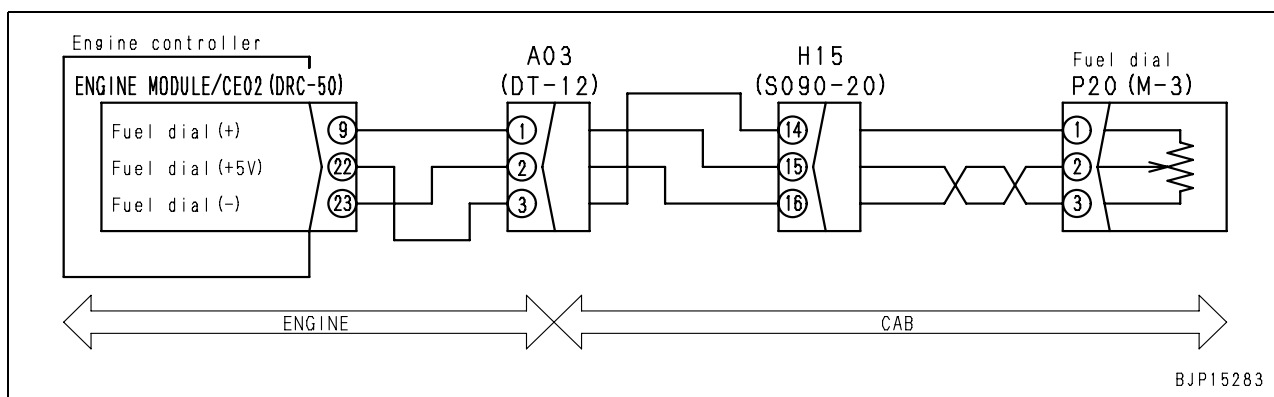


Failure code [CA2185] Throt sens sup volt high error

User code	Failure code	Trouble	Throttle sensor supply voltage high error (Engine controller system)
E14	CA2185		
Contents of trouble	<ul style="list-style-type: none"> High voltage (5.25 V or higher) was detected in throttle sensor power supply circuit. 		
Action of controller	<ul style="list-style-type: none"> If trouble occurs while starting switch is in ON position, controller fixes voltage value to level just before detection of trouble and continues operation. If starting switch is turned ON while voltage is abnormally high, controller continues operation with voltage at 100% value. 		
Problem that appears on machine	<ul style="list-style-type: none"> Engine speed cannot be controlled with fuel control dial. 		
Related information	<ul style="list-style-type: none"> Method of reproducing failure code: Turn starting switch ON. 		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Short circuit in wiring harness (With another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE02 (female) (22) – each of CE02 (female) pins (With P20 disconnected)	Resistance	Min. 100 kΩ
			Wiring harness between CE02 (female) (22) – CE03 (female) (3) (With P20 disconnected)	Resistance	Min. 100 kΩ
	2	Defective wiring harness connector	Connecting parts between fuel control dial – machine wiring harness – engine controller may be defective. Check them directly. <ul style="list-style-type: none"> Looseness of connector, breakage of lock, or breakage of seal Corrosion, bend, breakage, push-in, or expansion of pin Moisture or dirt in connector or defective insulation 		
	3	Defective engine controller	If causes 1 – 2 are not detected, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

Circuit diagram related

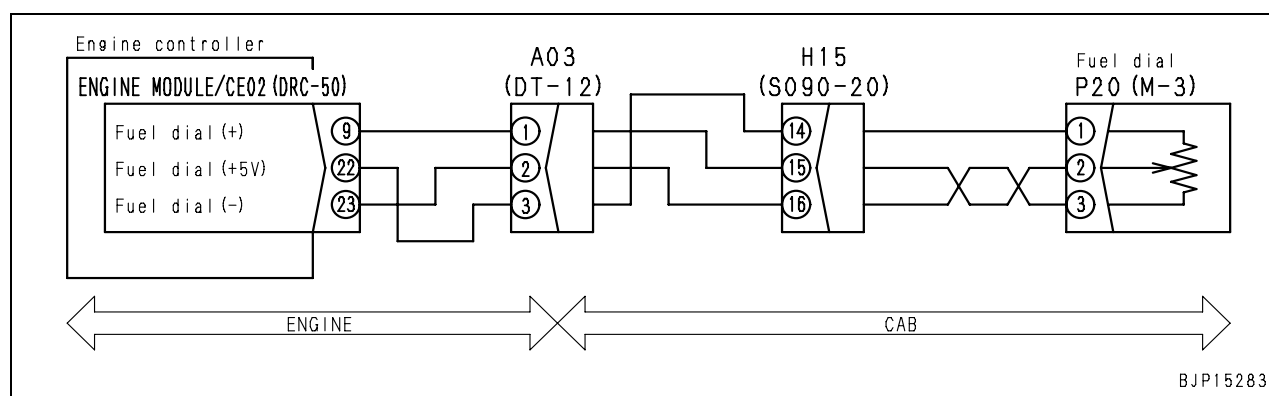


Failure code [CA2186] Throt sens sup volt low error

User code	Failure code	Trouble	Throttle sensor supply voltage low error (Engine controller system)
E14	CA2186		
Contents of trouble	<ul style="list-style-type: none"> Low voltage was detected in throttle sensor power supply circuit. 		
Action of controller	<ul style="list-style-type: none"> If trouble occurs while starting switch is in ON position, controller fixes voltage value to level just before detection of trouble and continues operation. If starting switch is turned ON while voltage is abnormally high, controller continues operation with voltage at 100% value. 		
Problem that appears on machine	<ul style="list-style-type: none"> Engine speed cannot be controlled with fuel control dial. 		
Related information	<ul style="list-style-type: none"> Method of reproducing failure code: Turn starting switch ON. 		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE02 (female) (22) – P20 (female) (1)	Resistance	Min. 100 kΩ
	2	Short circuit in wiring harness (With another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE02 (female) (9) – each of CE02 (female) pins (With P20 disconnected)	Resistance	Min. 100 kΩ
	3	Defective wiring harness connector	Connecting parts between fuel control dial – machine wiring harness – engine controller may be defective. Check them directly. <ul style="list-style-type: none"> Looseness of connector, breakage of lock, or breakage of seal Corrosion, bend, breakage, push-in, or expansion of pin Moisture or dirt in connector or defective insulation 		
	4	Defective engine controller	If causes 1 – 3 are not detected, engine controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

Circuit diagram related



Failure code [CA2249] Rail press very low error

User code	Failure code	Trouble	Rail pressure very low error (Engine controller system)
E11	CA2249		
Contents of trouble	• There is low pressure error in common rail circuit.		
Action of controller	• Limits output and continues operation.		
Problem that appears on machine	• Engine does not start easily. • Exhaust gas becomes black. • Engine output lowers.		
Related information	• Common rail pressure can be checked with monitoring function. (Code 36400 : Common rail pressure) • Method of reproducing failure code: Start engine.		

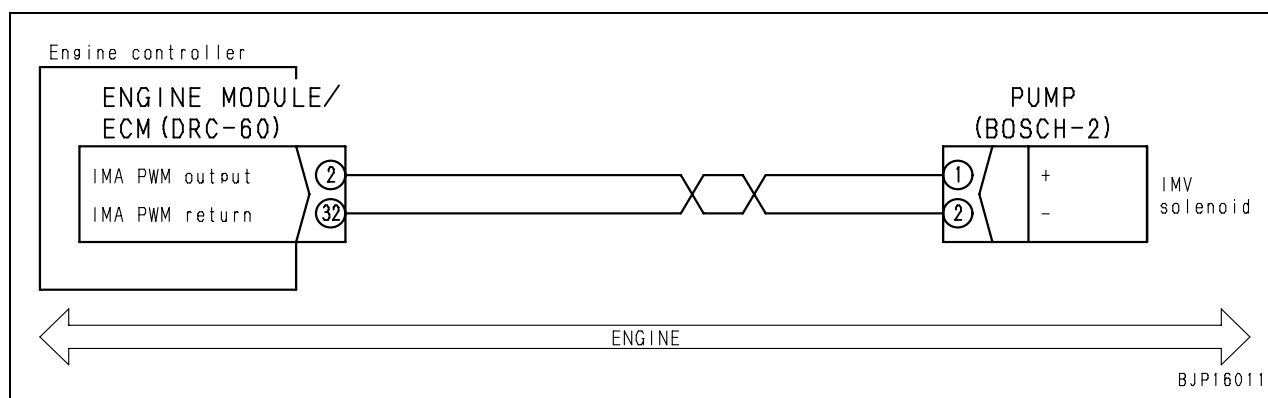
Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1		
	1	Carry out troubleshooting for failure code [CA559].	

Failure code [CA2311] IMV solenoid error

User code	Failure code	Trouble	IMV solenoid error (Engine controller system)
E11	CA2311		
Contents of trouble	• Resistance of supply pump actuator circuit is abnormally high or low.		
Action of controller	• None in particular.		
Problem that appears on machine	• Engine output lowers.		
Related information	• Method of reproducing failure code: Start engine.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defect in related system	If another failure code is displayed, carry out troubleshooting for it.		
	2	Defective supply pump actuator	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			PUMP (male)		Resistance
			Between (1) – (2)		Max. 5 Ω
			Between (1) – chassis ground		Min. 100 kΩ
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ECM (female) (2) – PUMP (female) (1)		Resistance Max. 5 Ω
			Wiring harness between ECM (female) (32) – PUMP (female) (2)		Resistance Max. 5 Ω
	4	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between ECM (female) (2) – PUMP (female) (1)		Resistance Min. 100 kΩ
	5	Defective wiring harness connector	Connecting parts between supply pump actuator – engine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation		
	6	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			ECM (female)		Resistance
			Between (2) – (32)		Max. 5 Ω
			Between (2) – chassis ground		Min. 100 kΩ

Circuit diagram related

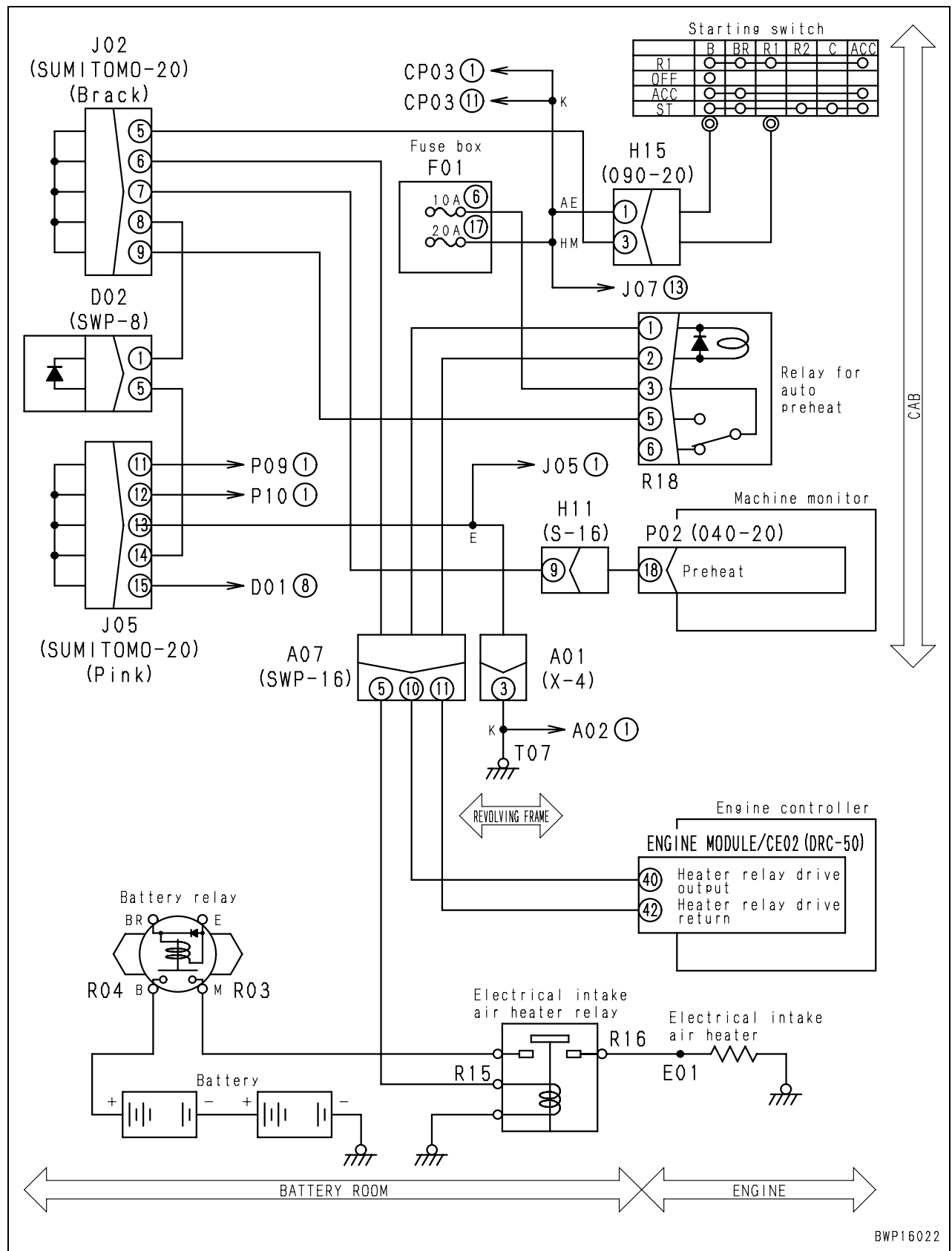


Failure code [CA2555] Grid htr relay volt high error

User code	Failure code	Trouble	Grid heater relay volt high error (Engine controller system)
E15	CA2555		
Contents of trouble	• Disconnection was detected in drive circuit of intake air heater relay.		
Action of controller	• None in particular.		
Problem that appears on machine	• Intake air heater does not work (Engine does not start easily and exhaust gas becomes white at low temperature).		
Related information	• Method of reproducing failure code: Turn starting switch ON when engine coolant temperature is below -4°C .		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective automatic pre-heater relay (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON. (Troubleshooting for relay unit)			
			R18 (male)		Resistance	
			Between (1) – (2)		300 – 600 Ω	
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting. (Troubleshooting by replacement)			
			Replace automatic preheater relay (R18)) with another relay and perform reproducing operation. If "E" of failure code goes off at this time, replaced relay is defective.			
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CE02 (female) (40) – R18 (female) (1)		Resistance	Max. 10 Ω
			Wiring harness between CE02 (female) (42) – R18 (female) (2)		Resistance	Max. 10 Ω
	3	Short circuit in wiring harness (With another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CE02 (female) (40) – each of CE02 (female) pins (With R18 disconnected)		Resistance	Min. 100 kΩ
	4	Defective wiring harness connector	Connecting parts between automatic preheater relay – machine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation			
	5	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			CE02 (female)		Resistance	
			Between (40) – (42)		300 – 600 Ω	

Circuit diagram related

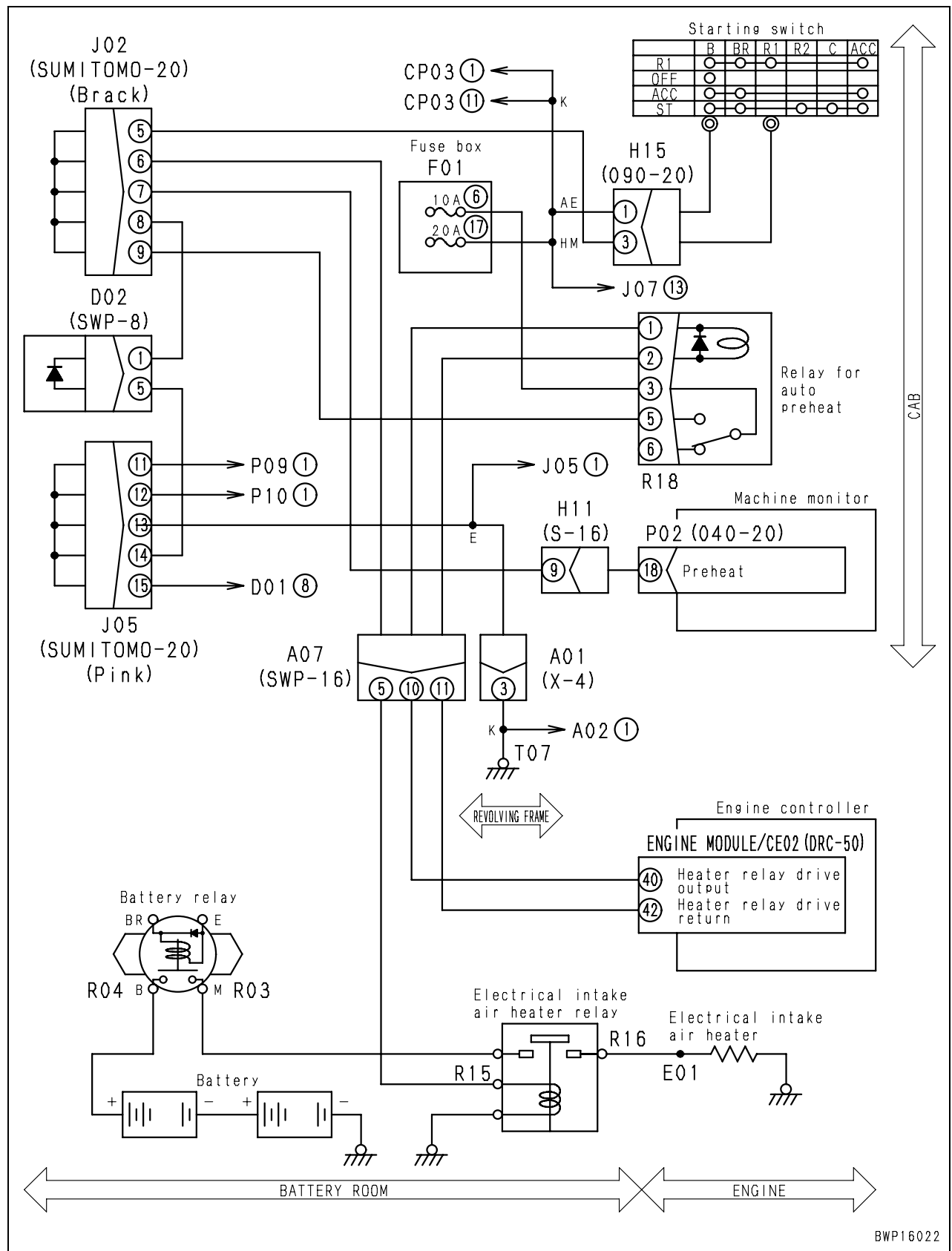


Failure code [CA2556] Grid htr relay volt low error

User code	Failure code	Trouble	Grid heater relay volt low error (Engine controller system)
E15	CA2556		
Contents of trouble	• Short circuit was detected in drive circuit of intake air heater relay.		
Action of controller	• None in particular.		
Problem that appears on machine	• Intake air heater does not work (Engine does not start easily and exhaust gas becomes white at low temperature).		
Related information	• Method of reproducing failure code: Turn starting switch ON when engine coolant temperature is below −4°C.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective automatic pre-heater relay (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON. (Troubleshooting for relay unit)		
			R18 (male)		Resistance
			Between (1) – (2)		300 – 600 Ω
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting. (Troubleshooting by replacement)		
			Replace automatic preheater relay (R18)) with another relay and perform reproducing operation. If "E" of failure code goes off at this time, replaced relay is defective.		
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE02 (female) (40) – R18 (female) (1)		Resistance Min. 100 kΩ
	3	Short circuit in wiring harness (With another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE02 (female) (40) – each of CE02 (female) pins (With R18 disconnected)		Resistance Min. 100 kΩ
	4	Defective wiring harness connector	Connecting parts between automatic preheater relay – machine wiring harness – engine controller may be defective. Check them directly. • Looseness of connector, breakage of lock, or breakage of seal • Corrosion, bend, breakage, push-in, or expansion of pin • Moisture or dirt in connector or defective insulation		
	5	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			CE02 (female)		Resistance
			Between (40) – (42)		300 – 600 Ω

Circuit diagram related



PC160LC-7E0, PC180LC/NLC-7E0 Hydraulic excavator

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HYDRAULIC EXCAVATOR

PC160LC-7E0

PC180LC-7E0

PC180NLC-7E0

Machine model Serial number

PC160LC-7E0	K45001 and up
PC180LC-7E0	K45001 and up
PC180NLC-7E0	K45001 and up

40 Troubleshooting

Troubleshooting by failure code, Part 3

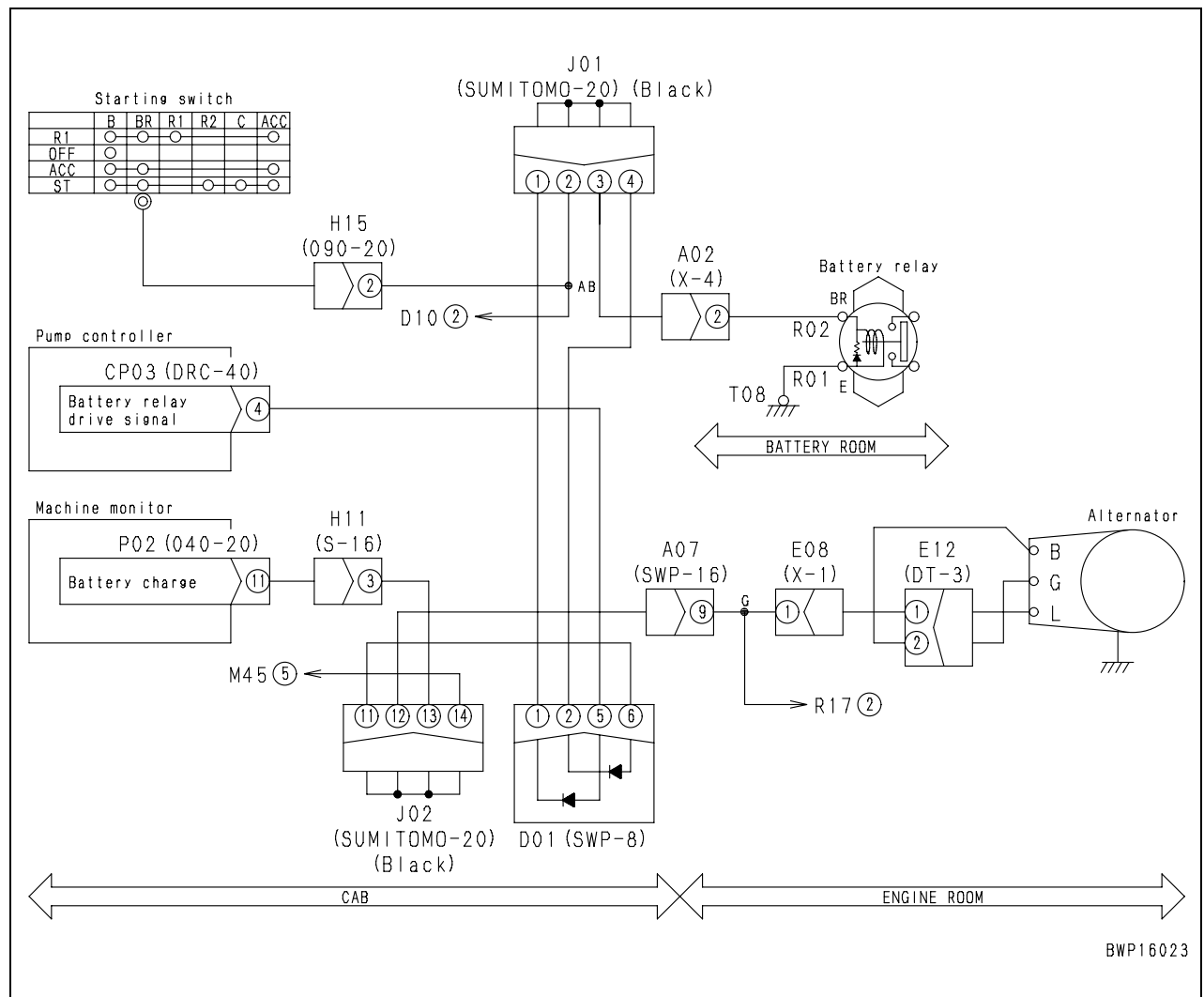
Failure code [D110KB] Battery relay drive S/C	2
Failure code [D196KA] Service return relay disc.	4
Failure code [D196KB] Service return relay S/C.....	6
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Failure code [D110KB] Battery relay drive S/C

User code	Failure code	Trouble	Battery relay drive short (Pump controller system)
—	D110KB		
Contents of trouble	• Abnormal current flowed at output to battery relay drive circuit.		
Action of controller	• Turns output to battery relay drive circuit OFF. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• Engine does not stop.		
Related information	• Operating condition of battery relay (ON/OFF) can be checked with monitoring function. (Code 03700 : Controller output)		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting				
	1	Defective battery relay (Internal defect)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.				
			Battery relay		Resistance		
			Between R02 (terminal BR) – R01 (terminal E)		There is continuity		
			Between R02 (terminal BR) – chassis ground		Min. 1 MΩ		
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.				
			Wiring harness between CP03 (female) (4) – D01 – J01 – R02 (terminal BR) and chassis ground		Resistance	Min. 1 MΩ	
	3	Defective pump controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.				
			CP03 (female)	Turn starting switch OFF.		Voltage	
			Between (4) – chassis ground	ON → OFF		20 – 30 V (4 – 7 sec.)	

Circuit diagram related

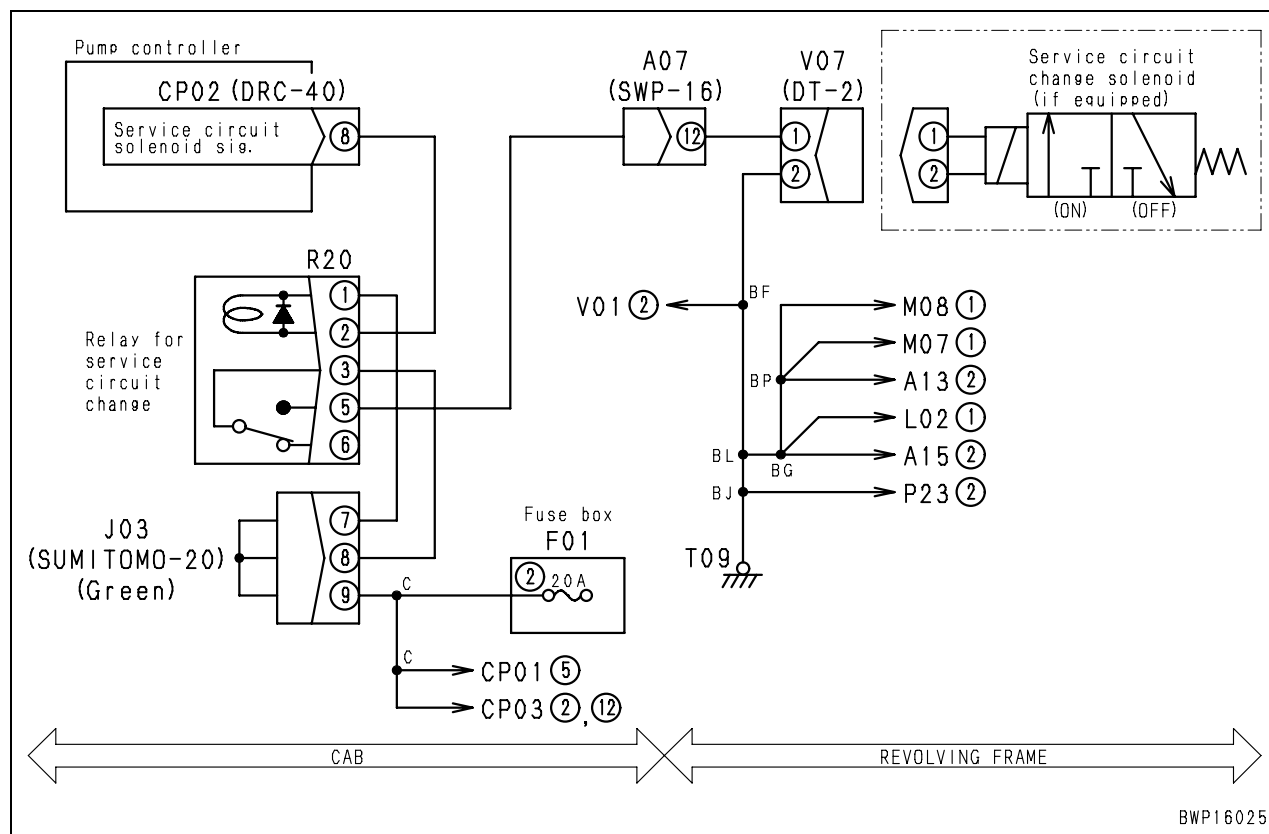


Failure code [D196KA] Service return relay disc.

User code	Failure code	Trouble	Service return relay disconnection (Pump controller system)
—	D196KA		
Contents of trouble	• When service return relay circuit was disconnected with GND (when output was turned OFF), 24V was not generated.		
Action of controller	• None in particular. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Hydraulic circuit for attachment does not change to single operation circuit.		
Related information	• Carry out troubleshooting only for setting with ATT. (Confirm settings on machine monitor.) ★ This code detects only a trouble in the primary side (coil side) of service return relay. When service return solenoid may be in defective operation, check the power supply, wiring harness, and solenoid in the secondary side (Limit SW side) of the relay. • Operating condition of service return relay (ON/OFF) can be checked with monitoring function. (Code 02301 : Solenoid 2)		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective fuse No.2	If fuse is broken, circuit probably has ground fault. (See cause 4.)			
	2	Defective service return relay (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			R20 (male)		Resistance	
			Between (1) – (2)		100 – 500 Ω	
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CP02 (female) (8) – R20 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between R20 (female) (1) – J03 – F01 (2) outlet		Resistance	Max. 1 Ω
	4	Hot short in wiring harness (Short circuit with 24V circuit)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between CP02 (female) (8) – R20 (female) (2) and chassis ground		Voltage	Max. 1V
	5	Defective pump controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			CP02	Working mode	Voltage	
			Between (8) – chassis ground	When B-mode is not selected	20 – 30 V	
When B-mode is selected				Max. 1 V		

Circuit diagram related

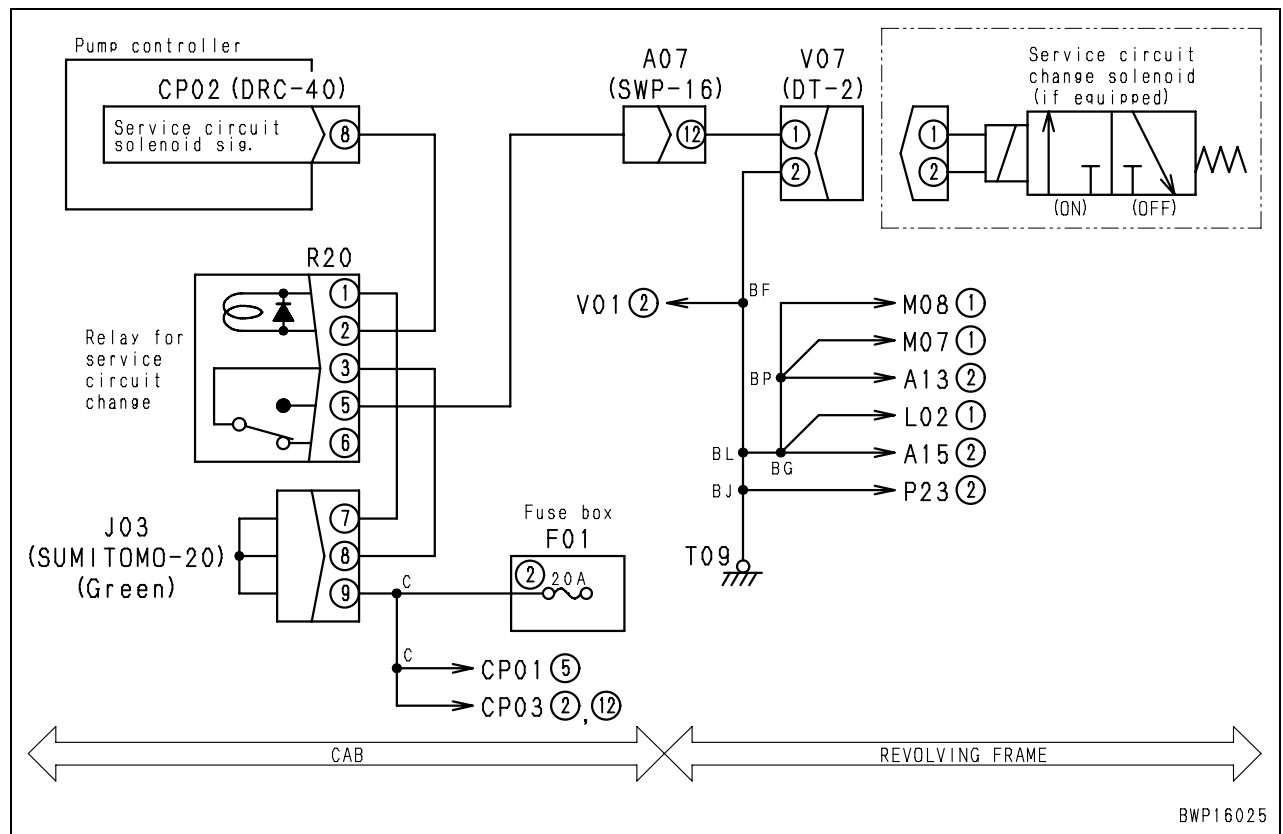


Failure code [D196KB] Service return relay S/C

User code	Failure code	Trouble	Service return relay short (Pump controller system)
—	D196KB		
Contents of trouble	• When service return relay circuit was connected to GND (when output was turned ON), abnormal current flowed.		
Action of controller	• Turns output to service return relay circuit OFF. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• Hydraulic circuit for attachment does not change to single operation circuit.		
Related information	• Carry out troubleshooting only for setting with ATT. (Confirm settings on machine monitor.) ★ This code detects only a trouble in the primary side (coil side) of service return relay. When service return solenoid may be in defective operation, check the power source, wiring harness, and solenoid in the secondary side (Limit SW side) of the relay. • Operating condition of service return relay (ON/OFF) can be checked with monitoring function. (Code 02301 : Solenoid 2)		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective service return relay (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			R20 (male)		Resistance	
			Between (1) – (2)		100 – 500 Ω	
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CP02 (female) (8) – R20 (female) (2) and chassis ground		Resistance	Min. 1 MΩ
			Wiring harness between R20 (female) (1) – J03 – F01 (2) outlet and chassis ground		Resistance	Min. 1 MΩ
	3	Defective pump controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			CP02		Working mode	Voltage
Between (8) – chassis ground			When B-mode is not selected		20 – 30 V	
			When B-mode is selected		Max. 1 V	

Circuit diagram related

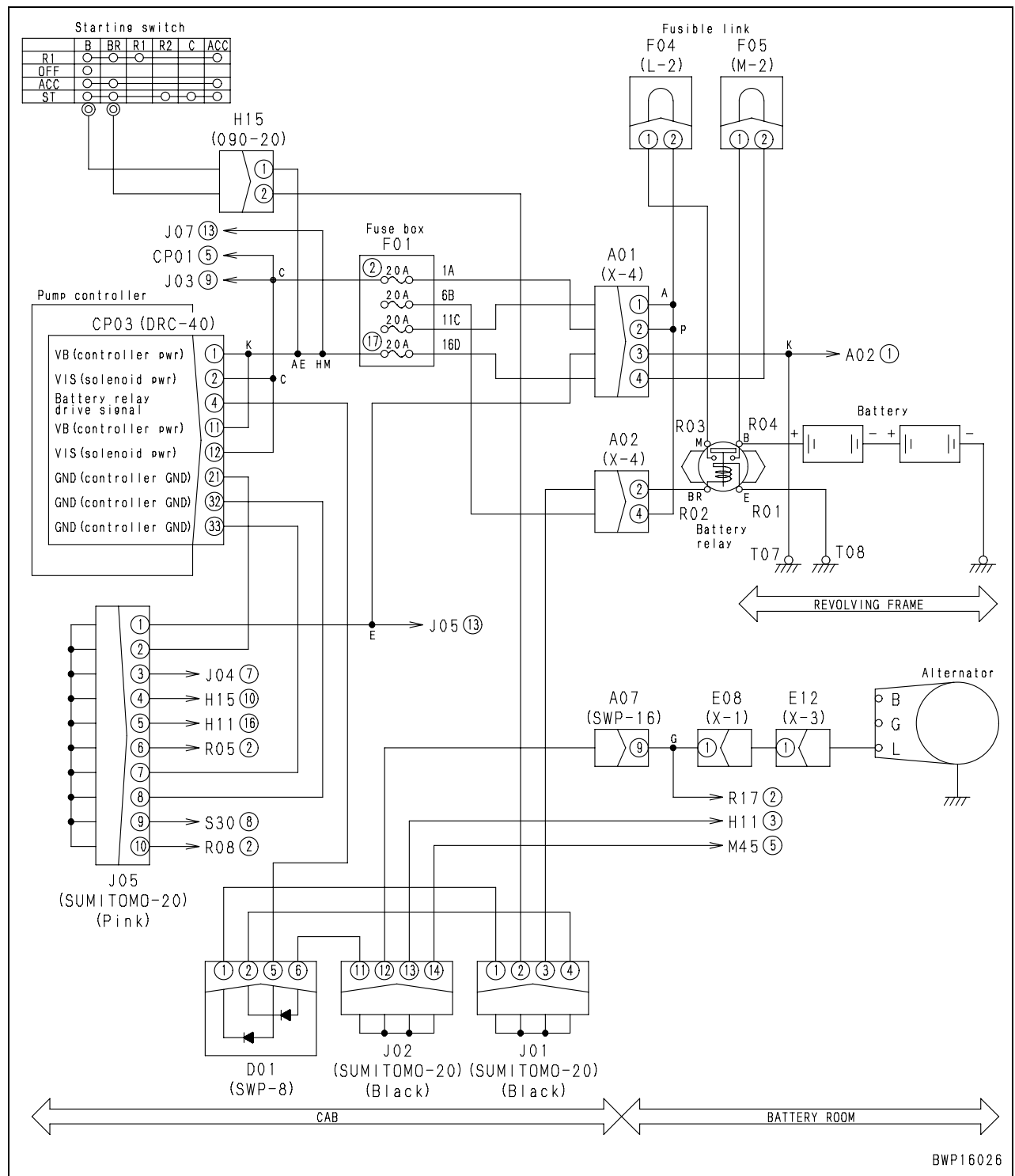


Failure code [DA22KK] Pump solenoid power low error

User code	Failure code	Trouble	Pump solenoid power low error (Pump controller system)
E0E	DA22KK		
Contents of trouble	• Pump controller solenoid source voltage is below 18 V.		
Action of controller	• Solenoid stops operation.		
Problem that appears on machine	• Work equipment, swing, and travel systems do not work.		
Related information	• If [D110KB] is displayed, carry out troubleshooting for it first.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective fuse No. 2 or fusible link F04	If fuse or fusible link is broken, circuit probably has ground fault. (See cause 3.)		
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CP03 (female) (2), (12) – fuse F01 (2) outlet	Resistance	Max. 1 Ω
			Wiring harness between fuse F01 (11C) inlet – A01 – F04 (female) (2)	Resistance	Max. 1 Ω
			Wiring harness between F04 (female) (1) – battery relay terminal M (R03)	Resistance	Max. 1 Ω
			Wiring harness between starting switch terminal BR – H15 – J01 – A02 – battery relay terminal BR (R02)	Resistance	Max. 1 Ω
			Wiring harness between CP03 (female) (21), (32), (33) – chassis ground	Resistance	Max. 1 Ω
	3	Ground fault in wiring harness	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CP03 (female) (2), (12) – fuse F01 (2) outlet	Resistance	Min. 1 MΩ
			Wiring harness between fuse F01 (11C) inlet – A01 – F04 (female) (2)	Resistance	Min. 1 MΩ
			Wiring harness between F04 (female) (1) – battery relay terminal M (R03)	Resistance	Min. 1 MΩ
	4	Defective pump controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Between CP03 (2), (12) – (21), (32), (33)	Voltage	20 – 30 V

Circuit diagram related



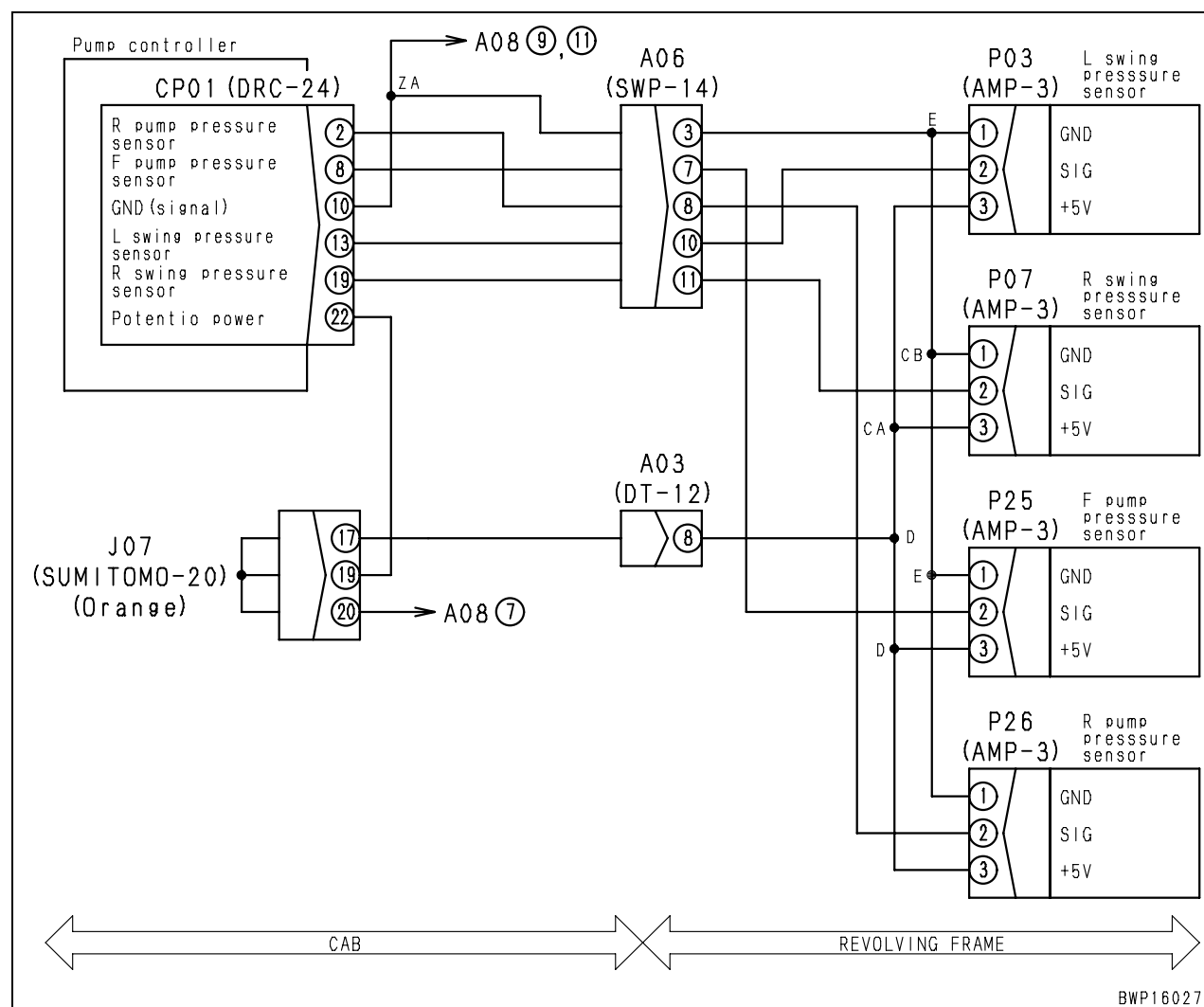
BWP16026

Failure code [DA25KP] Press. sensor power abnormality

User code	Failure code	Trouble	Pressure sensor power abnormality (Pump controller system)
E02	DA25KP		
Contents of trouble	<ul style="list-style-type: none"> Abnormal current flowed in pressure sensor power supply (5V) circuit. 		
Action of controller	<ul style="list-style-type: none"> Turns output to power supply (5V) circuit OFF. Even if phenomenon of failure disappears, system does not reset itself until starting switch is turned OFF. 		
Problem that appears on machine	<ul style="list-style-type: none"> Signal of pressure sensor is not input normally. Pressure sensor failure code is displayed at the same time. 		
Related information			

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective pressure sensor (Internal short circuit)	★ Disconnect connector with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Disconnect sensor and wiring harness at right in order. If no failure code is displayed, that sensor is defective.	F pump pressure sensor		P25 connector
				R pump pressure sensor		P26 connector
				Swing left pressure sensor		P03 connector
				Swing right pressure sensor		P07 connector
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CP01 (female) (22) – J07 – A03 – P25 (female) (3) and chassis ground [F pump pressure sensor system]		Resistance	Min. 1 MΩ
			Wiring harness between CP01 (female) (22) – J07 – A03 – P26 (female) (3) and chassis ground [R pump pressure sensor system]		Resistance	Min. 1 MΩ
			Wiring harness between CP01 (female) (22) – J07 – A03 – P03 (female) (3) and chassis ground [Swing left pressure sensor system]		Resistance	Min. 1 MΩ
			Wiring harness between CP01 (female) (22) – J07 – A03 – P07 (female) (3) and chassis ground [Swing right pressure sensor system]		Resistance	Min. 1 MΩ
	3	Defective pump controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			CP01		Voltage	
			Between (22) – (10)		4.5 – 5.5 V	

Circuit diagram related

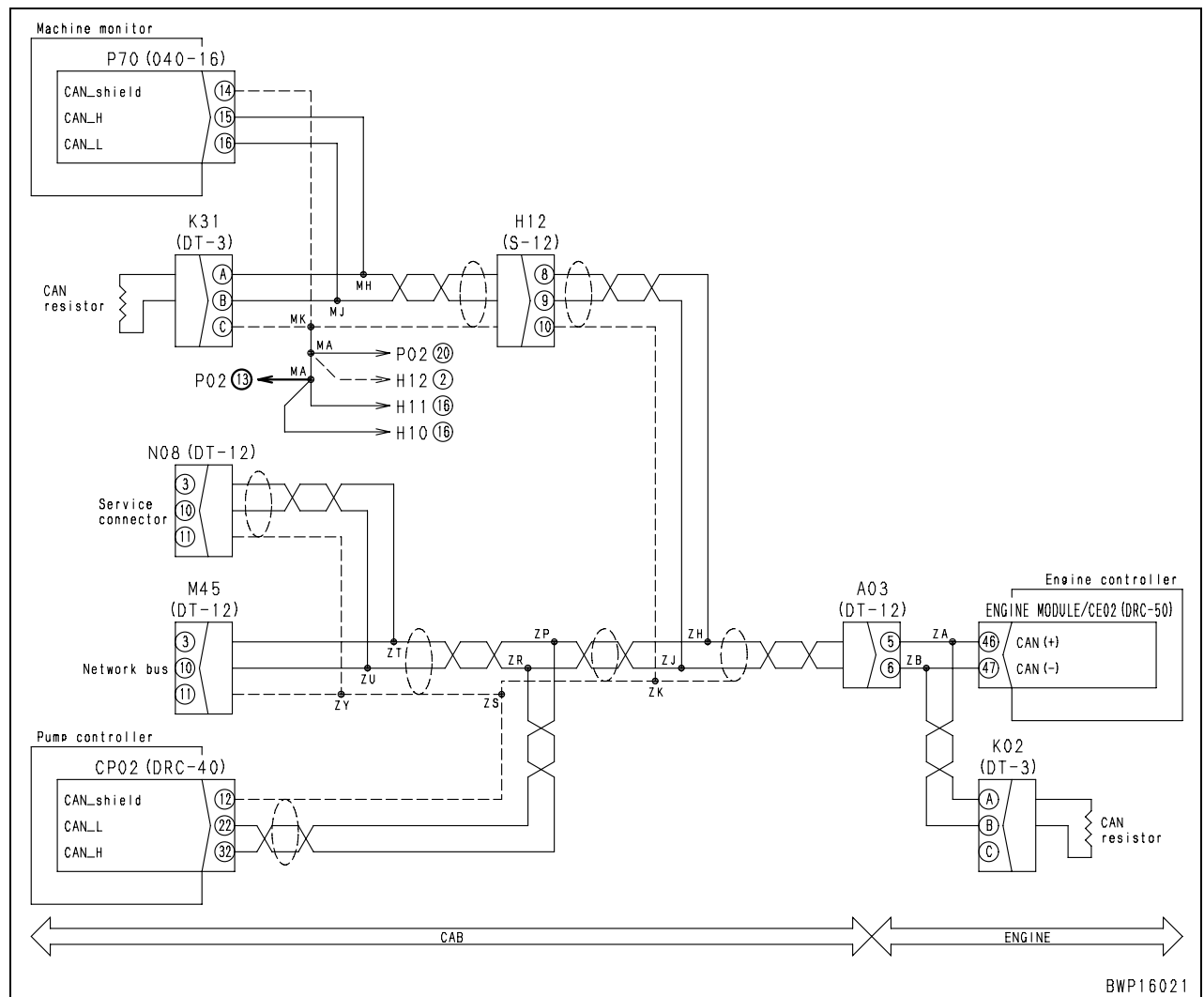


Failure code [DA2RMC] Pump comm. abnormality

User code	Failure code	Trouble	Pump communication abnormality (Pump controller system)
E0E	DA2RMC		
Contents of trouble	• Pump controller detected communication error in CAN communication circuit between machine monitor and engine controller.		
Action of controller	• Fix engine output to E-mode, and limit pump absorption torque to about 80%. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Output lowers. (Pump absorption torque decreases.) • As the working load increases, engine may stall.		
Related information			

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between P70 (female) (16) – CE02 (female) (47), – CP02 (female) (22)	Resistance	Max. 1 Ω
			Wiring harness between P70 (female) (15) – CE02 (female) (46), – CP02 (female) (32)	Resistance	Max. 1 Ω
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between P70 (female) (16) – CE02 (female) (47), – CP02 (female) (22), – other related circuit and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between P70 (female) (15) – CE02 (female) (46), – CP02 (female) (32), – other related circuit and chassis ground	Resistance	Min. 1 MΩ
	3	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between P70 (female) (16) – CE02 (female) (47), – CP02 (female) (22), – other related circuit and chassis ground	Voltage	Max. 1 V
			Wiring harness between P70 (female) (15) – CE02 (female) (46), – CP02 (female) (32), – other related circuit and chassis ground	Voltage	Max. 1 V
	4	Defective CAN terminal resistance	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			K02 (male), K31 (male)	Resistance	
			Between (A) – (B)	40 – 80 Ω	
	5	Defective machine monitor, engine controller, or pump controller	If causes 1 – 4 are not detected, machine monitor, engine controller, or pump controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

Circuit diagram related



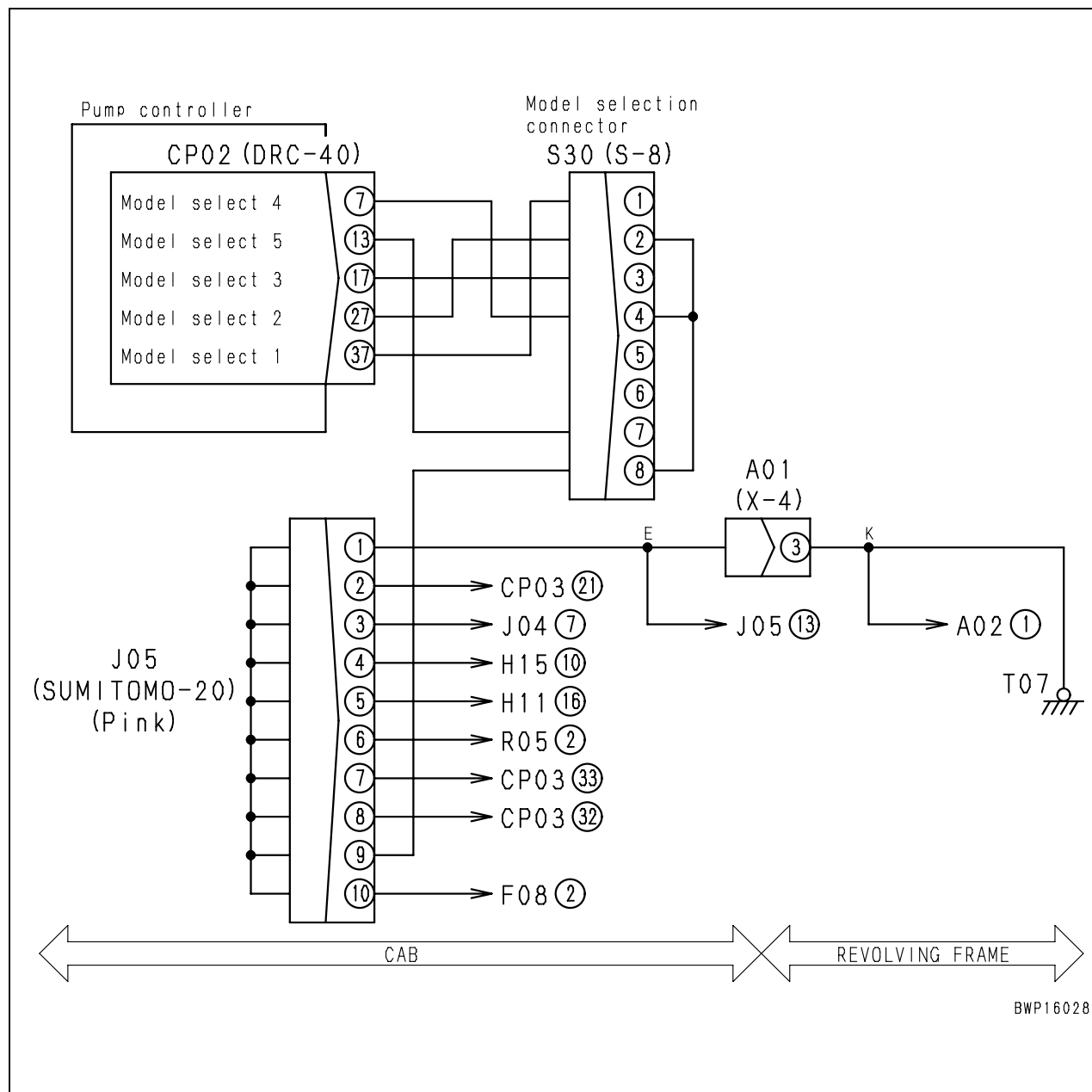
Failure code [DA2SKQ] Model selection abnormality

User code	Failure code	Trouble	Model selection abnormality (Pump controller system)
—	DA2SKQ		
Contents of trouble	• Model code signal for model which is not registered in controller is input.		
Action of controller	• Changes input model code to code of default model (PC300) and continues control. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• None in particular.		
Related information	• Controller-recognized model name (digits) can be checked with monitoring function. (Code: 00200 : Controller model select) • Input of model selection signal (ON/OFF) can be checked with monitoring function. (Code 02201 : Switch Input 2)		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective model selection connector (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			S30 (female)		Resistance
			Between (2), (4) – (8)		Max. 1 Ω
			Between (1), (3), (5), (6), (7) – (8)		Min. 1 MΩ
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CP02 (female) (7) – S30 (male) (4) and chassis ground	Resistance	Max. 1 Ω
			Wiring harness between CP02 (female) (17) – S30 (male) (3)	Resistance	Max. 1 Ω
			Wiring harness between CP02 (female) (27) – S30 (male) (2)	Resistance	Max. 1 Ω
			Wiring harness between CP02 (female) (13) – S30 (male) (7)	Resistance	Max. 1 Ω
			Wiring harness between CP02 (female) (37) – S30 (male) (1)	Resistance	Max. 1 Ω
			Wiring harness between S30 (male) (8) – J05 – A01 – chassis ground	Resistance	Max. 1 Ω
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CP02 (female) (7) – S30 (male) (4) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between CP02 (female) (13) – S30 (male) (7) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between CP02 (female) (17) – S30 (male) (3) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between CP02 (female) (37) – S30 (male) (1) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between CP02 (female) (27) – S30 (male) (2)	Resistance	Min. 1 MΩ

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting	
	4	Defective pump controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.	
			CP02	Voltage
			Between (7), (13), (37) – chassis ground	20 – 30 V
			Between (17) (27) – chassis ground	Max. 1 V

Circuit diagram related

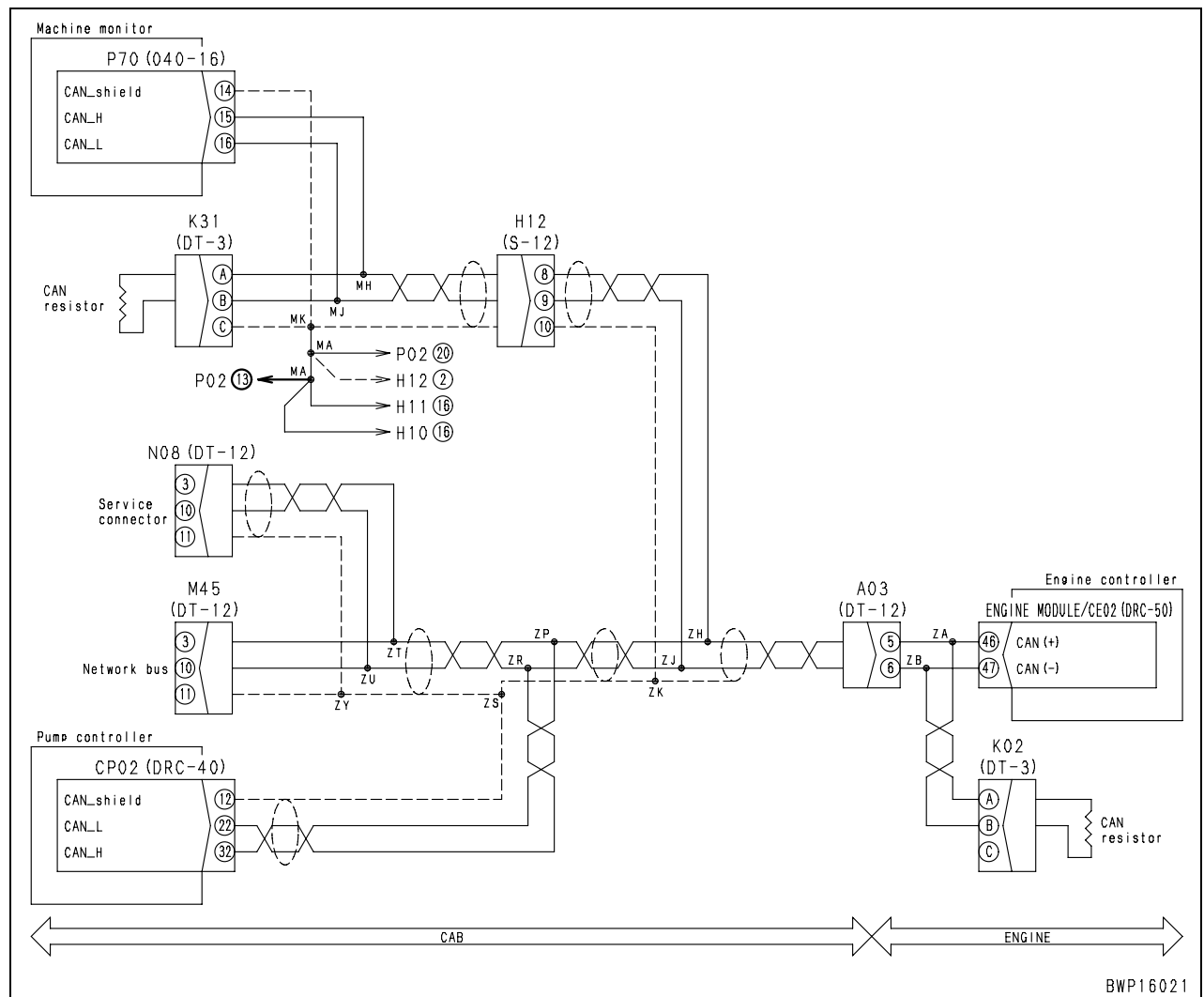


Failure code [DAFRMC] Monitor comm. abnormality

User code	Failure code	Trouble	Monitor communication abnormality (Machine monitor)
E0E	DAFRMC		
Contents of trouble	• Machine monitor detected communication error in CAN communication circuit between pump controller and engine controller.		
Action of controller	• Fix engine output to E-mode, and limit pump absorption torque to about 80%. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Output lowers. (Pump absorption torque decreases.) • As the working load increases, engine may stall.		
Related information			

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between P70 (female) (16) – CE02 (female) (47), – CP02 (female) (22)	Resistance	Max. 1 Ω
			Wiring harness between P70 (female) (15) – CE02 (female) (46), – CP02 (female) (32)	Resistance	Max. 1 Ω
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between P70 (female) (16) – CE02 (female) (47), – CP02 (female) (22), – other related circuit and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between P70 (female) (15) – CE02 (female) (46), – CP02 (female) (32), – other related circuit and chassis ground	Resistance	Min. 1 MΩ
	3	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between P70 (female) (16) – CE02 (female) (47), – CP02 (female) (22), – other related circuit and chassis ground	Voltage	Max. 1 V
			Wiring harness between P70 (female) (15) – CE02 (female) (46), – CP02 (female) (32), – other related circuit and chassis ground	Voltage	Max. 1 V
	4	Defective CAN terminal resistance	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			K02 (male), K31 (male)	Resistance	
			Between (A) – (B)	40 – 80 Ω	
	5	Defective machine monitor, engine controller, or pump controller	If causes 1 – 4 are not detected, machine monitor, engine controller, or pump controller may be defective. (Since trouble is in system, troubleshooting cannot be carried out.)		

Circuit diagram related

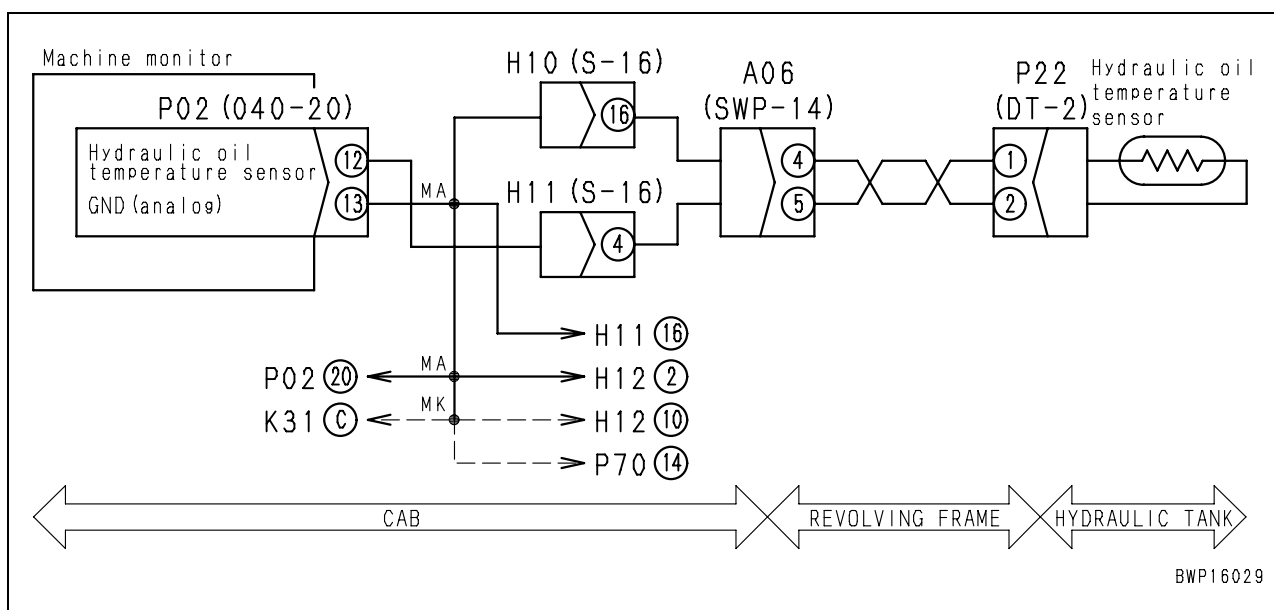


Failure code [DGH2KB] Hydr oil sensor short

User code	Failure code	Trouble	Hydraulic oil temperature sensor short (Machine monitor system)
—	DGH2KB		
Contents of trouble	• Ground fault was detected in hydraulic oil temperature sensor circuit.		
Action of controller	• Fixes hydraulic oil temperature value at 40°C and continues operation. • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• While hydraulic oil temperature rises normally, hydraulic oil temperature gauge does not move from top of white range (bottom of green range).		
Related information	• Signal voltage of hydraulic oil temperature sensor can be checked with monitoring function. (Code 04402 : Hydraulic oil temperature sensor voltage) • Method of reproducing failure code: Start engine.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective hydraulic oil temperature sensor (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			P22 (male)		Resistance	
			Between (1) – (2)		3.5 – 90 kΩ	
			Between (2) – chassis ground		Min. 1 MΩ	
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between P02 (female) (12) – P22 (female) (2)		Resistance	Min. 1 MΩ
	3	Defective machine monitor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			P02 (female)		Resistance	
			Between (12) – (13)		3.5 – 90 kΩ	
			Between (12) – chassis ground		Min. 1 MΩ	

Circuit diagram related

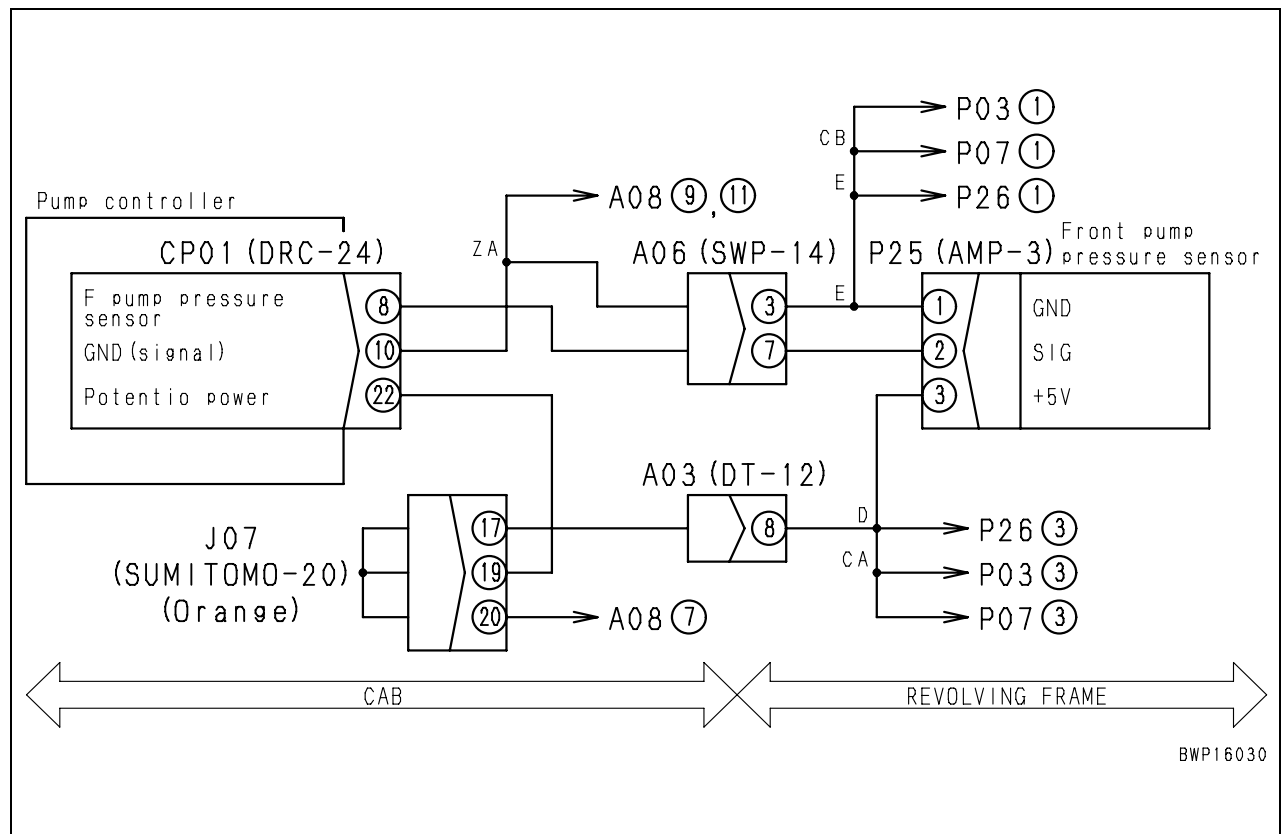


Failure code [DHPAMA] F pump press sensor abnormality

User code	Failure code	Trouble	F pump press sensor abnormality (Pump controller system)
—	DHPAMA		
Contents of trouble	<ul style="list-style-type: none"> Signal voltage from F pump pressure sensor is below 0.3 V or above 4.42 V. 		
Action of controller	<ul style="list-style-type: none"> Fixes F pump pressure at 0 MPa {0 kg/cm²} and continues control. If cause of failure disappears, system resets itself. 		
Problem that appears on machine	<ul style="list-style-type: none"> No automatic gear shifting 		
Related information	<ul style="list-style-type: none"> ★ If 5V circuit (3) and ground circuit (1) of pressure sensor are connected inversely, pressure sensor will be broken. Accordingly, take extreme care when checking. Input from F pump pressure sensor (pressure) can be checked with monitoring function. (Code 01112: F pump pressure sensor voltage) 		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective sensor power supply system	If failure code [DA25KP] is also displayed, carry out troubleshooting for it first.			
	2	Defective F pump pressure sensor (Internal defect)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			P25		Voltage	
			Between (3) – (1)		4.5 – 5.5 V	
			Between (2) – (1)		0.5 – 4.5 V	
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CP01 (female) (22) – J07 – A03 – P25 (female) (3)		Resistance	Max. 1 Ω
			Wiring harness between CP01 (female) (10) – A06 – P25 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between CP01 (female) (8) – A06 – P25 (female) (2)		Resistance	Max. 1 Ω
	4	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CP01 (female) (8) – A06 – P25 (female) (2) and chassis ground		Resistance	Min. 1 MΩ
	5	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between CP01 (female) (22) – J07 – A03 – P25 (female) (3) and chassis ground		Voltage	4.5 – 5.5 V
			Wiring harness between CP01 (female) (8) – A06 – P25 (female) (2) and chassis ground		Voltage	Max. 1 V
	6	Defective pump controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			CP01		Voltage	
			Between (22) – (10)		4.5 – 5.5 V	
			Between (8) – (10)		0.5 – 4.5 V	

Circuit diagram related

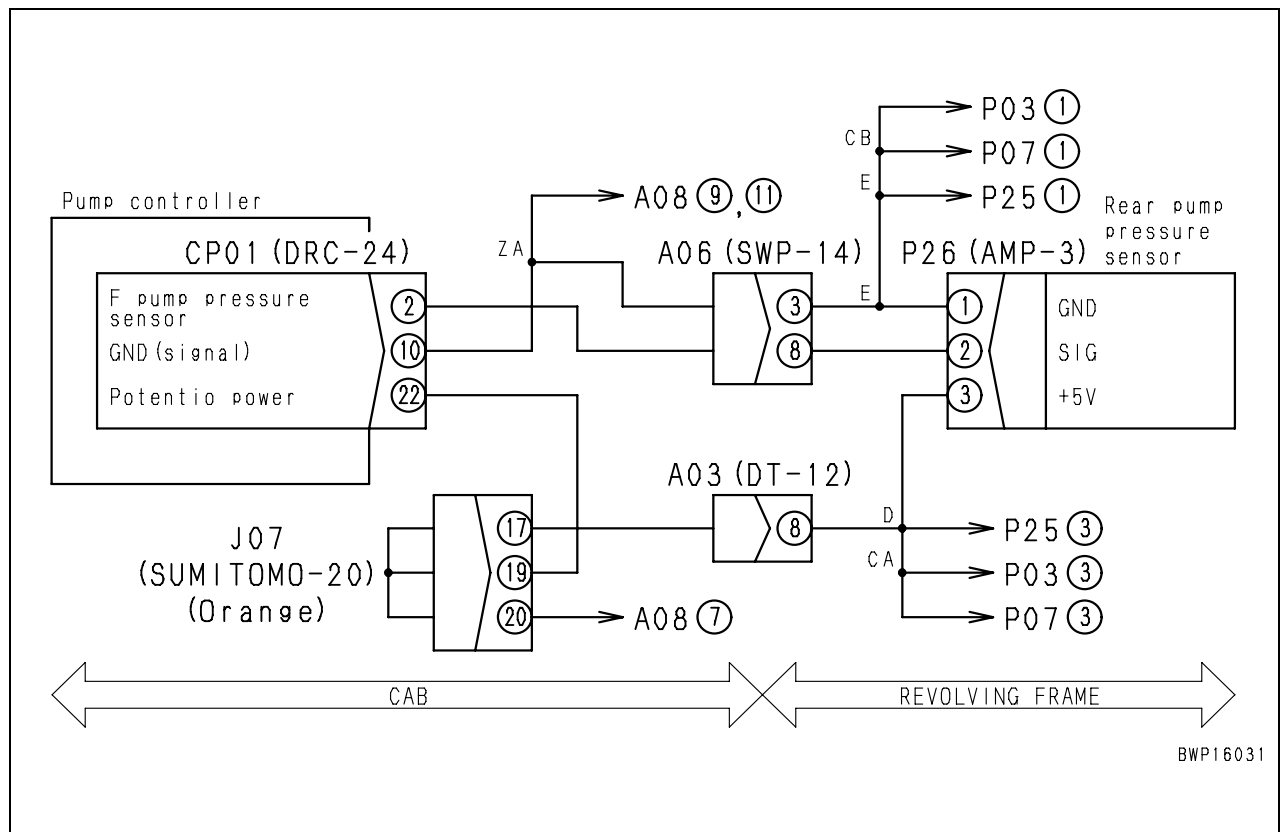


Failure code [DHPBMA] R pump press sensor abnormality

User code	Failure code	Trouble	R pump pressure sensor abnormality (Pump controller system)
—	DHPBMA		
Contents of trouble	<ul style="list-style-type: none"> Signal voltage from R pump pressure sensor is below 0.3 V or above 4.42 V. 		
Action of controller	<ul style="list-style-type: none"> Fixes R pump pressure at 0 MPa {0 kg/cm²} and continues control. If cause of failure disappears, system resets itself. 		
Problem that appears on machine	<ul style="list-style-type: none"> No automatic gear shifting 		
Related information	<ul style="list-style-type: none"> ★ If 5V circuit (3) and ground circuit (1) of pressure sensor are connected inversely, pressure sensor will be broken. Accordingly, take extreme care when checking. Input from R pump pressure sensor (pressure) can be checked with monitoring function. (Code 01113: R pump pressure sensor voltage) 		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective sensor power supply system	If failure code [DA25KP] is also displayed, carry out troubleshooting for it first.		
	2	Defective R pump pressure sensor (Internal defect)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.		
			P26	Voltage	
			Between (3) – (1)	4.5 – 5.5 V	
			Between (2) – (1)	0.5 – 4.5 V	
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CP01 (female) (22) – J07 – A03 – P26 (female) (3)	Resistance	Max. 1 Ω
			Wiring harness between CP01 (female) (10) – A06 – P26 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between CP01 (female) (2) – A06 – P26 (female) (2)	Resistance	Max. 1 Ω
	4	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CP01 (female) (2) – A06 – P26 (female) (2) and chassis ground	Resistance	Min. 1 MΩ
	5	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between CP01 (female) (22) – J07 – A03 – P26 (female) (3) and chassis ground	Voltage	4.5 – 5.5 V
			Wiring harness between CP01 (female) (2) – A06 – P26 (female) (2) and chassis ground	Voltage	0.5 – 4.5 V
	6	Defective pump controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.		
			CP01	Voltage	
			Between (22) – (10)	4.5 – 5.5 V	
Between (2) – (10)			0.5 – 4.5 V		

Circuit diagram related

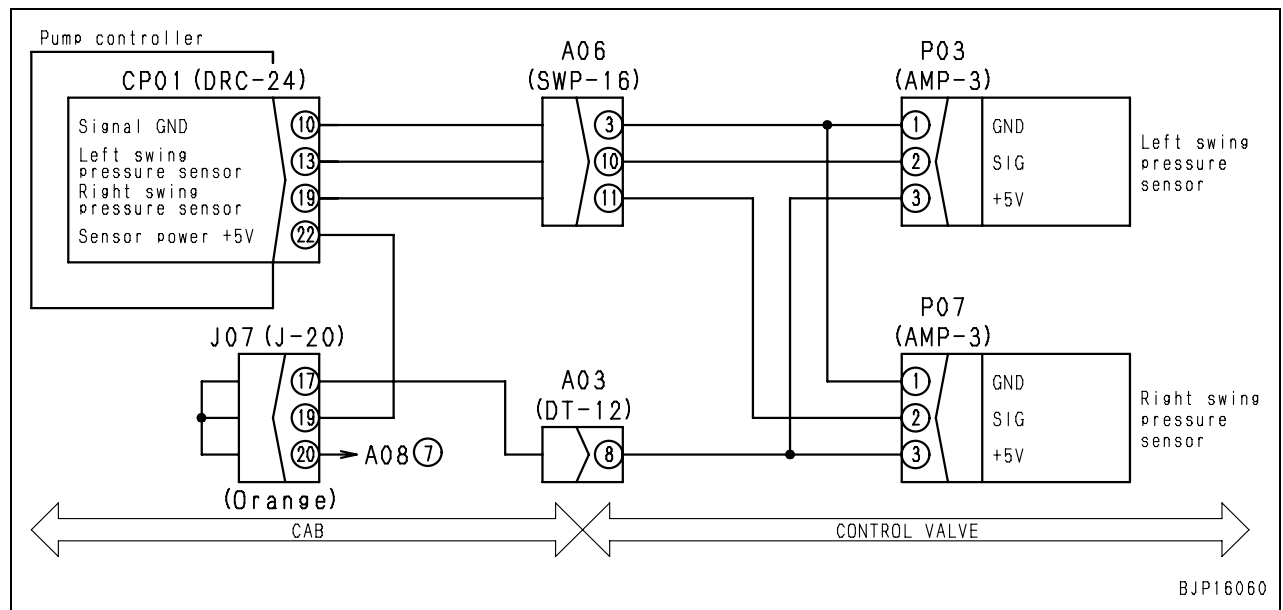


Failure code [DHSAMA] Sw RH PPC press sen. abnormality

User code	Failure code	Trouble	Sw RH PPC press sen. abnormality (Pump controller system)
—	DHSAMA		
Contents of trouble	<ul style="list-style-type: none"> Signal voltage from swing right PPC pressure sensor is below 0.3 V or above 4.72 V. 		
Action of controller	<ul style="list-style-type: none"> Fixes swing right PPC pressure at 0 MPa {0 kg/cm²} and continues control. If cause of failure disappears, system resets itself. 		
Problem that appears on machine	<ul style="list-style-type: none"> No automatic gear shifting 		
Related information	<ul style="list-style-type: none"> ★ If 5V circuit (3) and ground circuit (1) of pressure sensor are connected inversely, pressure sensor will be broken. Accordingly, take extreme care when checking. Input from swing right PPC pressure sensor (pressure) can be checked with monitoring function. (Code 09002: Swing right PPC pressure) 		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective sensor power supply system	If failure code [DA25KP] is also displayed, carry out troubleshooting for it first.			
	2	Defective swing right PPC pressure sensor (Internal defect)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			P07		Voltage	
			Between (3) – (1)		4.5 – 5.5 V	
			Between (2) – (1)		0.5 – 4.5 V	
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CP01 (female) (22) – J07 – A03 – P07 (female) (3)		Resistance	Max. 1 Ω
			Wiring harness between CP01 (female) (10) – A06 – P07 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between CP01 (female) (19) – A06 – P07 (female) (2)		Resistance	Max. 1 Ω
	4	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CP01 (female) (19) – A06 – P07 (female) (2) and chassis ground		Resistance	Min. 1 MΩ
	5	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between CP01 (female) (22) – J07 – A03 – P07 (female) (3) and chassis ground		Voltage	4.5 – 5.5 V
			Wiring harness between CP01 (female) (19) – A06 – P07 (female) (2) and chassis ground		Voltage	0.5 – 4.5 V
	6	Defective pump controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			CP01		Voltage	
			Between (22) – (10)		4.5 – 5.5 V	
Between (19) – (10)			0.5 – 4.5 V			

Circuit diagram related

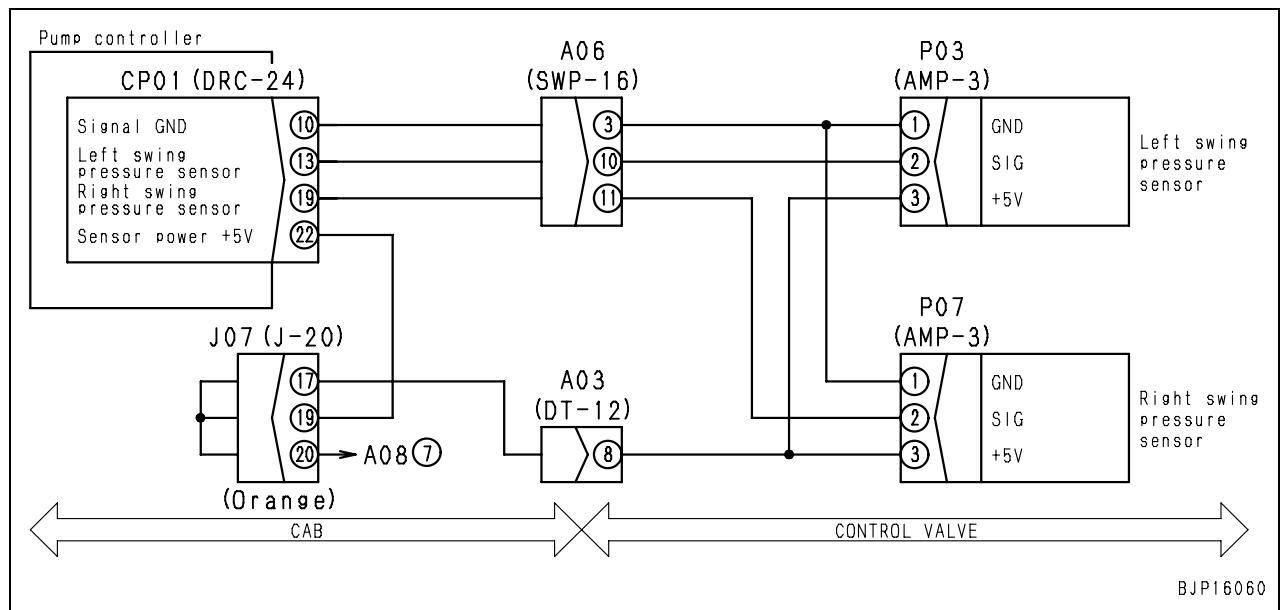


Failure code [DHSBMA] Sw LH PPC press sen. abnormality

User code	Failure code	Trouble	Sw LH PPC press sen. abnormality (Pump controller system)
—	DHSBMA		
Contents of trouble	<ul style="list-style-type: none"> Signal voltage from swing left PPC pressure sensor is below 0.3 V or above 4.42 V. 		
Action of controller	<ul style="list-style-type: none"> Fixes swing left PPC pressure at 0 MPa {0 kg/cm²} and continues control. If cause of failure disappears, system resets itself. 		
Problem that appears on machine	<ul style="list-style-type: none"> No automatic gear shifting 		
Related information	<ul style="list-style-type: none"> ★ If 5V circuit (3) and ground circuit (1) of pressure sensor are connected inversely, pressure sensor will be broken. Accordingly, take extreme care when checking. Input from swing left PPC pressure sensor (pressure) can be checked with monitoring function. (Code 09001: Swing left PPC pressure) 		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective sensor power supply system	If failure code [DA25KP] is also displayed, carry out troubleshooting for it first.			
	2	Defective swing left PPC pressure sensor (Internal defect)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			P03		Voltage	
			Between (3) – (1)		4.5 – 5.5 V	
			Between (2) – (1)		0.5 – 4.5 V	
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CP01 (female) (22) – J07 – A03 – P03 (female) (3)		Resistance	Max. 1 Ω
			Wiring harness between CP01 (female) (10) – A06 – P03 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between CP01 (female) (13) – A06 – P03 (female) (2)		Resistance	Max. 1 Ω
	4	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CP01 (female) (13) – A06 – P03 (female) (2) and chassis ground		Resistance	Min. 1 MΩ
	5	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between CP01 (female) (22) – J07 – A03 – P03 (female) (3) and chassis ground		Voltage	4.5 – 5.5 V
			Wiring harness between CP01 (female) (13) – A06 – P03 (female) (2) and chassis ground		Voltage	0.5 – 4.5 V
	6	Defective pump controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			CP01		Voltage	
			Between (22) – (10)		4.5 – 5.5 V	
			Between (13) – (10)		0.5 – 4.5 V	

Circuit diagram related



PC160LC-7E0, PC180LC/NLC-7E0 Hydraulic excavator

Form No. UEN02115-00

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HYDRAULIC EXCAVATOR

PC160LC-7E0

PC180LC-7E0

PC180NLC-7E0

Machine model Serial number

PC160LC-7E0	K45001 and up
PC180LC-7E0	K45001 and up
PC180NLC-7E0	K45001 and up

40 Troubleshooting

Troubleshooting by failure code, Part 4

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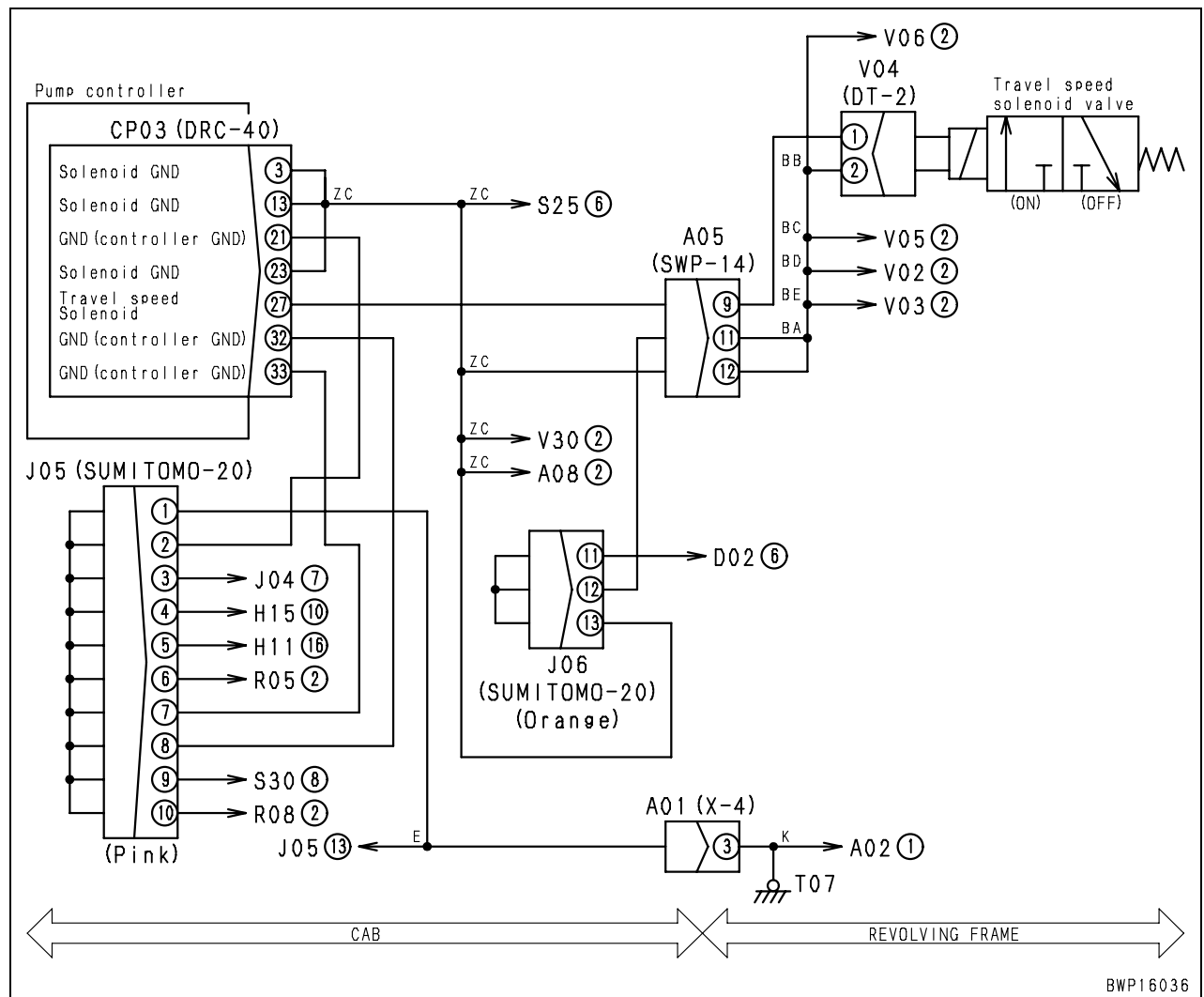
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Failure code [DW43KA] Travel speed sol. disc.

User code	Failure code	Trouble	Travel speed solenoid disconnection (Pump controller system)
—	DW43KA		
Contents of trouble	• No current flows at output to travel speed solenoid circuit.		
Action of controller	• None in particular. (Since no current flows, solenoid does not operate.) • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Travel speed does not change to Hi. (Machine monitor changes to the normal state.)		
Related information	• Operating condition of travel speed solenoid (ON/OFF) can be checked with monitoring function. (Code 02300 : Solenoid 1) • Solenoid detects disconnection when output is turned on. To confirm the reproduction after repair, be sure to turn output on. (For more information on how to turn output on/off, see troubleshooting for failure code [DW43KB].)		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective travel speed solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			V04 (male)		Resistance
			Between (1) – (2)		20 – 60 Ω
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CP03 (female) (27) – A05 – V04 (female) (1)		Resistance Max. 1 Ω
			Wiring harness between V04 (female) (2) – A05 – CP03 (female) (3), (13), (23)		Resistance Max. 1 Ω
	3	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between CP03 (female) (27) – A05 – V04 (female) (1) and chassis ground		Voltage Max. 1 V
	4	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			CP03 (female)		Resistance
			Between (27) – chassis ground		20 – 60 Ω

Circuit diagram related

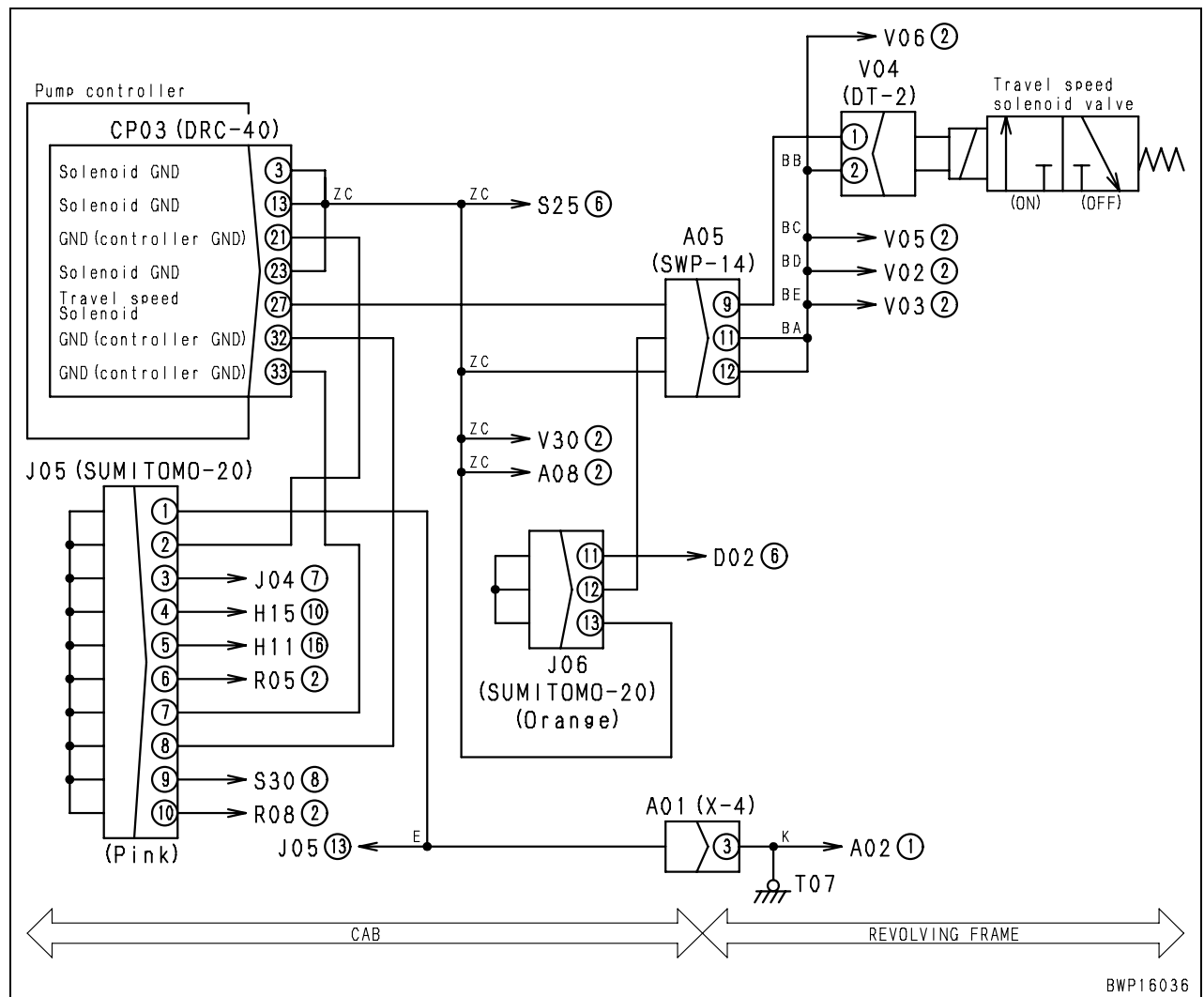


Failure code [DW43KB] Travel speed sol. S/C

User code	Failure code	Trouble	Travel speed solenoid short (Pump controller system)
—	DW43KB		
Contents of trouble	<ul style="list-style-type: none"> Abnormal current flowed at output to travel speed solenoid circuit. 		
Action of controller	<ul style="list-style-type: none"> Turns output to travel speed solenoid circuit OFF. Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF. 		
Problem that appears on machine	<ul style="list-style-type: none"> Travel speed does not change to Hi. (Machine monitor changes to the normal state.) 		
Related information	<ul style="list-style-type: none"> Operating condition of travel speed solenoid (ON/OFF) can be checked with monitoring function. (Code 02300: Solenoid 1) 		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting				
	1	Defective travel speed solenoid (Internal short circuit or ground fault)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.				
			V04 (male)		Resistance		
			Between (1) – (2)		20 – 60 Ω		
			Between (1) – chassis ground		Min. 1 MΩ		
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.				
			Wiring harness between CP03 (female) (27) – A05 – V04 (female) (1) and chassis ground		Resistance	Min. 1 MΩ	
	3	Defective pump controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.				
			CP03		Travel speed	Voltage	
			Between (27) – chassis ground	Lo		Max. 1 V	
				Hi + Travel operation		20 – 30 V	

Circuit diagram related



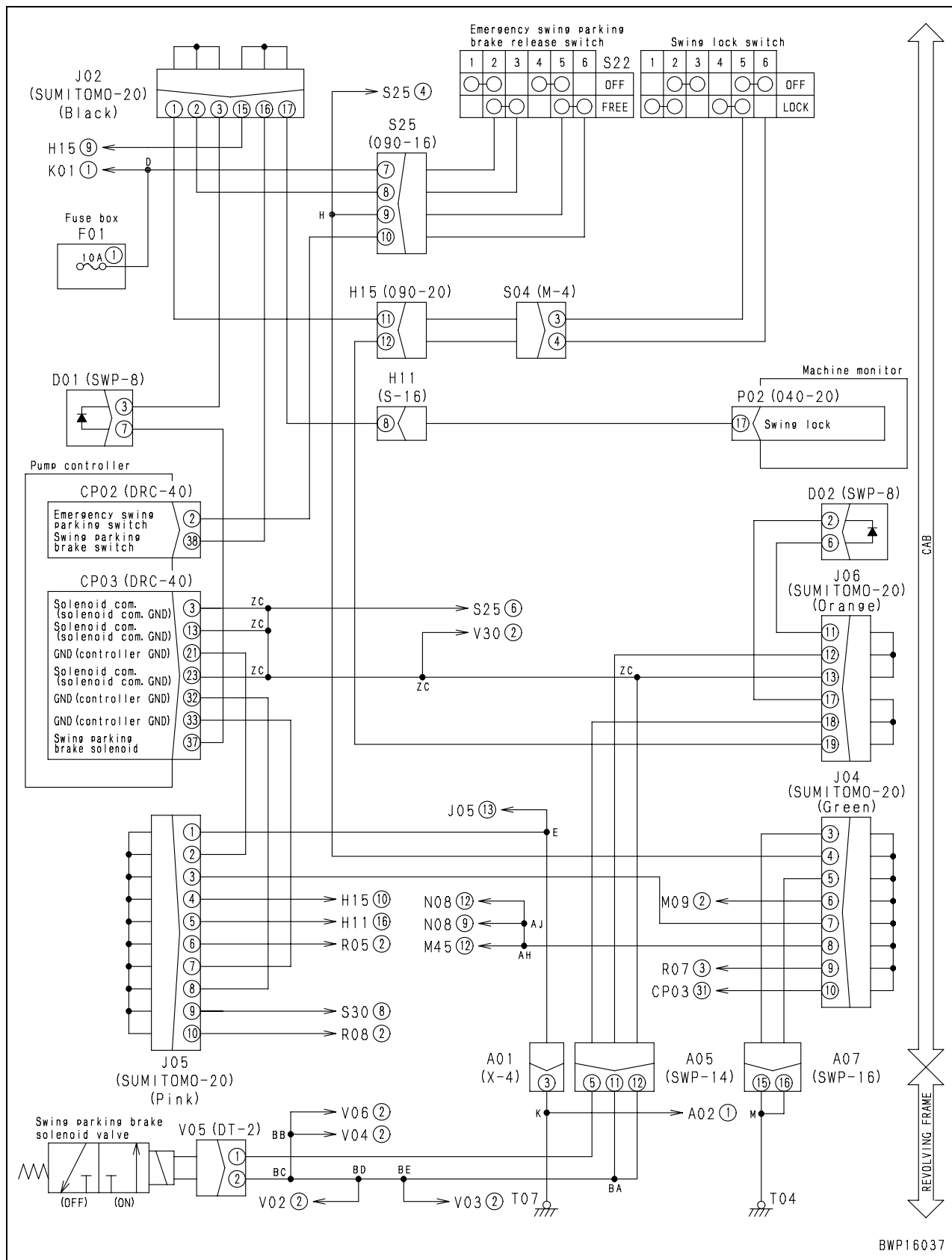
Failure code [DW45KA] Swing brake sol. disc.

User code	Failure code	Trouble	Swing holding brake solenoid disconnection (Pump controller system)
E03	DW45KA		
Contents of trouble	<ul style="list-style-type: none"> No current flows at output to swing holding brake solenoid circuit. 		
Action of controller	<ul style="list-style-type: none"> None in particular. (Since no current flows, solenoid does not operate.) If cause of failure disappears, system resets itself. 		
Problem that appears on machine	<ul style="list-style-type: none"> Machine cannot swing. 		
Related information	<ul style="list-style-type: none"> Operating condition of swing holding brake solenoid (ON/OFF) can be checked with monitoring function. (Code 02300: Solenoid 1) If solenoid and wiring harness are normal, operator can swing machine by setting emergency swing brake release switch in release position (Swing holding brake does not work, however, when machine stops). Turn both of swing lock and emergency swing release switches OFF during troubleshooting. Solenoid detects disconnection when output is turned on. To confirm the reproduction after repair, be sure to turn output on. (For more information on how to turn output on/off, see troubleshooting for failure code [DW45KB].) 		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting				
	1	Defective swing holding brake solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.				
			V05 (male)		Resistance		
			Between (1) – (2)		20 – 60 Ω		
	2	Defective swing lock switch (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.				
			S04 (female)	Switch	Resistance		
			Between (3) – (4)	OFF		Max. 1 Ω	
				LOCK		Min. 1 MΩ	
	3	Defective assembled-type diode D01 (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.				
			D01 (male)	Digital circuit tester	Continuity		
			Between (7) – (3)	Diode mode	There is continuity		
	4	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.				
			Wiring harness between CP03 (female) (37) – D01 (female) (7)		Resistance	Max. 1 Ω	
			Wiring harness between D01 (female) (3) – J02 – H15 – S04 (male) (3)		Resistance	Max. 1 Ω	
			Wiring harness between S04 (male) (4) – H15 – J06 – A05 – V05 (female) (1)		Resistance	Max. 1 Ω	
			Wiring harness between V05 (female) (2) – CP03 (female) (3), (13), (23)		Resistance	Max. 1 Ω	

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	5	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between CP03 (female) (37) – D01 – J02 – H15 – S04 (male) (3) and chassis ground	Voltage	Max. 1 V
			Wiring harness between V05 (female) (1) – A05 – J06 – H15 – S04 (male) (4) and chassis ground	Voltage	Max. 1 V
	6	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			CP03 (female)	Disconnect D01 and connect pins (3) and	Resistance
			Between (37) – chassis ground	(7) on male side directly.	20 – 60 Ω

Circuit diagram related

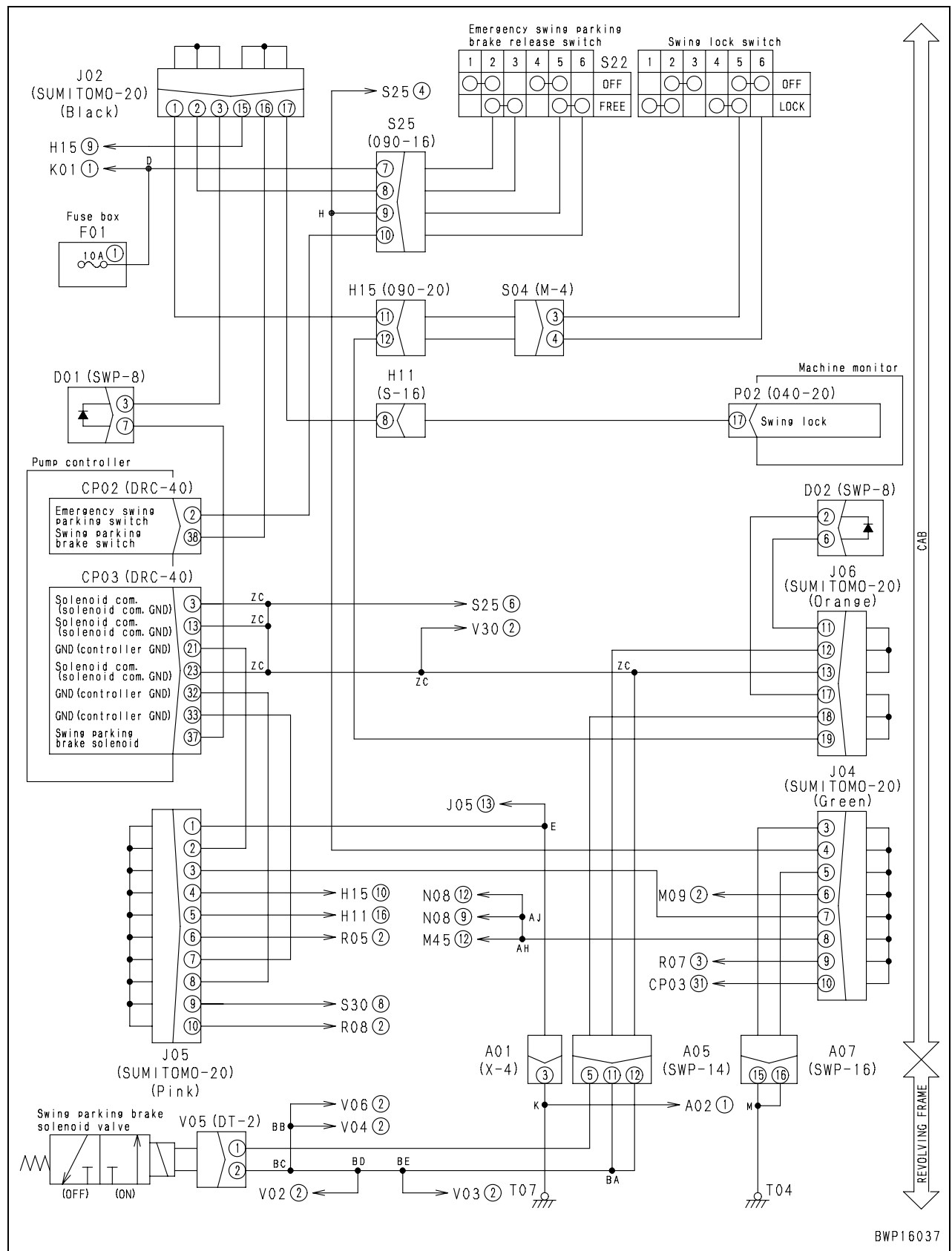


Failure code [DW45KB] Swing brake sol. S/C

User code	Failure code	Trouble	Swing holding brake solenoid short (Pump controller system)
E03	DW45KB		
Contents of trouble	<ul style="list-style-type: none"> Abnormal current flowed at output to swing holding brake solenoid circuit. 		
Action of controller	<ul style="list-style-type: none"> Turns output to swing holding brake solenoid circuit OFF. Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF. 		
Problem that appears on machine	<ul style="list-style-type: none"> Machine cannot swing. 		
Related information	<ul style="list-style-type: none"> Operating condition of swing holding brake solenoid (ON/OFF) can be checked with monitoring function. (Code 02300: Solenoid 1) If solenoid and wiring harness are normal, operator can swing machine by setting emergency swing brake release switch in release position (Swing holding brake does not work, however, when machine stops). 		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective swing holding brake solenoid (Internal short circuit or ground fault)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			V05 (male)		Resistance	
			Between (1) – (2)		20 – 60 Ω	
			Between (1) – chassis ground		Min. 1 MΩ	
	2	Defective assembled-type diode D01 (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			D01 (male)		Resistance	
			Between (3) – (7)		Min. 1 MΩ	
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CP03 (female) (37) – D01 – J02 – H15 – S04 (male) (3) and chassis ground		Resistance	Min. 1 MΩ
			Wiring harness between V05 (female) (1) – A05 – J06 – H15 – S04 (male) (4) and chassis ground		Resistance	Min. 1 MΩ
	4	Defective pump controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			CP03	Swing lever	Voltage	
			Between (37) – chassis ground	At neutral	Max. 1 V	
				At swing	20 – 30 V	

Circuit diagram related

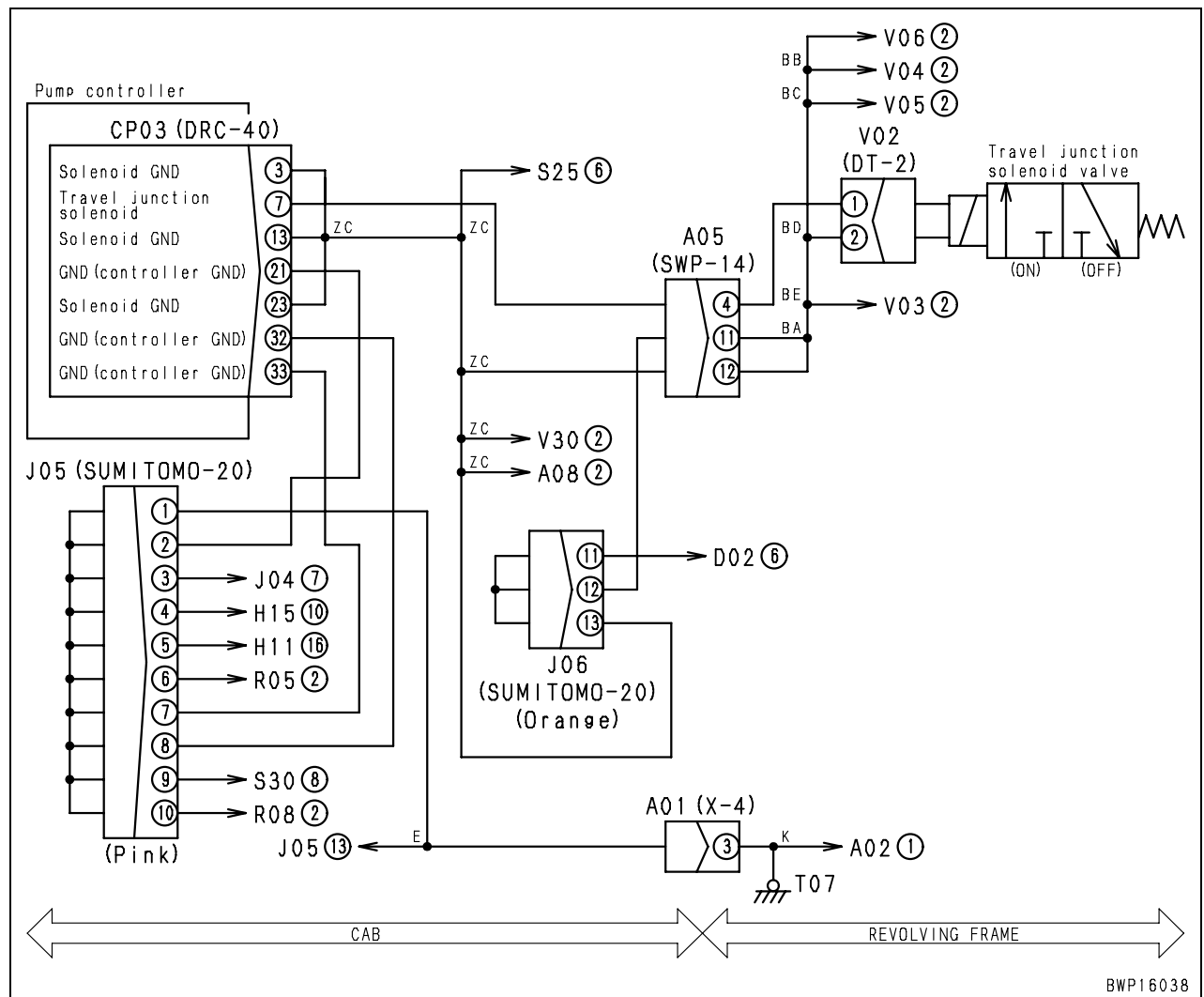


Failure code [DW91KA] Travel junction sol. disc.

User code	Failure code	Trouble	Travel junction solenoid disconnection (Pump controller system)
—	DW91KA		
Contents of trouble	• No current flows at output to travel junction solenoid circuit.		
Action of controller	• None in particular. (Since no current flows, solenoid does not operate.) • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Hard to turn when operating travel steering.		
Related information	• Operating condition of travel junction solenoid (ON/OFF) can be checked with monitoring function. (Code 02300 : Solenoid 1) • Solenoid detects disconnection when output is turned on. To confirm the reproduction after repair, be sure to turn output on. (For more information on how to turn output on/off, see troubleshooting for failure code [DW91KB].)		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective travel junction solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			V02 (male)		Resistance	
			Between (1) – (2)		20 – 60 Ω	
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CP03 (female) (7) – A05 – V02 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between V02 (female) (2) – A05 – CP03 (female) (3), (13), (23) and chassis ground		Resistance	Max. 1 Ω
	3	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between CP03 (female) (7) – A05 – V02 (female) (1) and chassis ground		Voltage	Max. 1 V
	4	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			CP03 (female)		Resistance	
			Between (7) – (3), (13), (23)		20 – 60 Ω	

Circuit diagram related

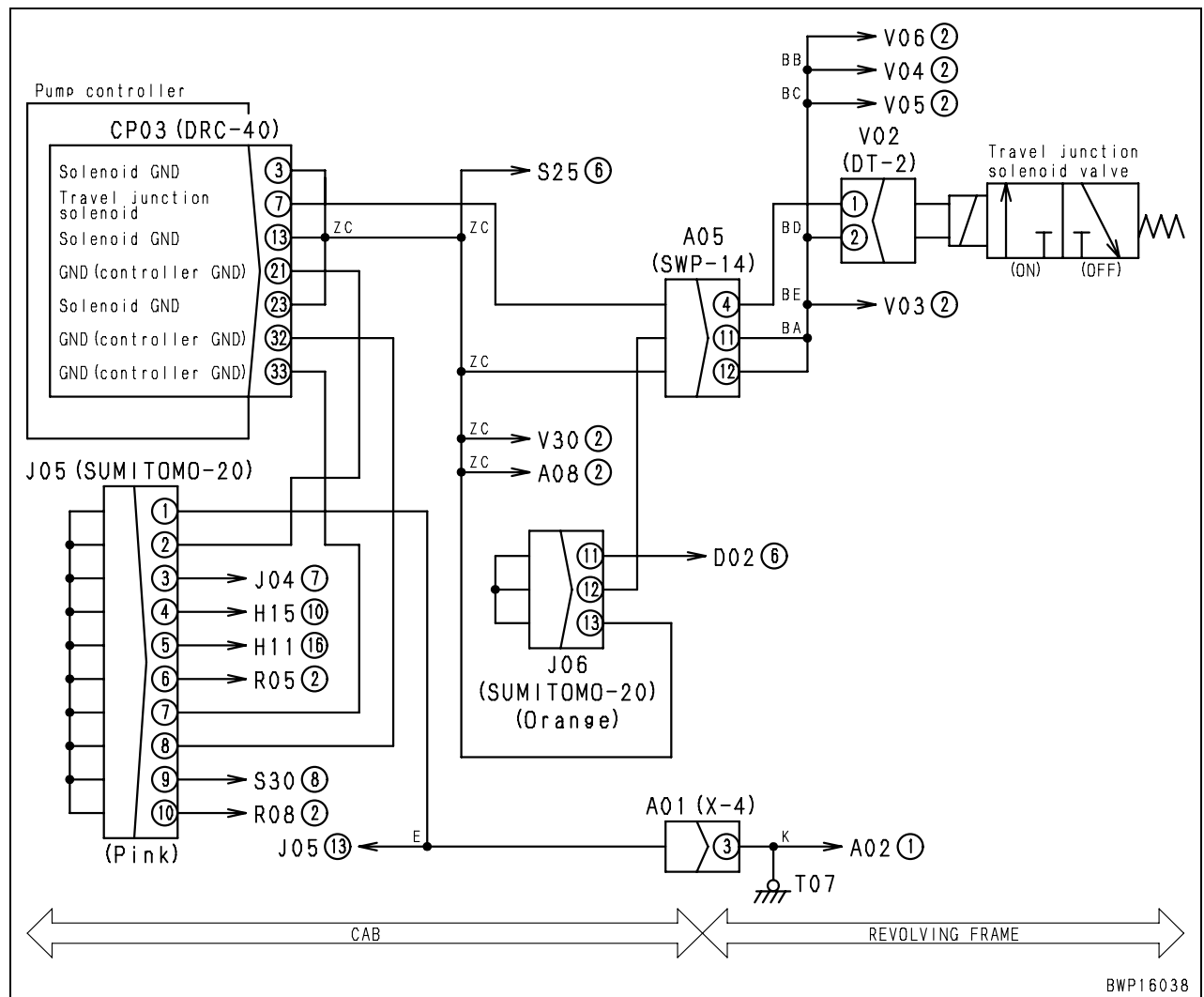


Failure code [DW91KB] Travel junction sol. S/C

User code	Failure code	Trouble	Travel junction solenoid short (Pump controller system)
—	DW91KB		
Contents of trouble	• Abnormal current flowed at output to travel junction solenoid circuit.		
Action of controller	• Turns output to travel junction solenoid OFF. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• Hard to turn when operating travel steering.		
Related information	• Operating condition of travel junction solenoid (ON/OFF) can be checked with monitoring function. (Code 02300 : Solenoid 1)		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective travel junction solenoid (Internal short circuit or ground fault)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			V02 (male)		Resistance
			Between (1) – (2)		20 – 60 Ω
			Between (1) – chassis ground		Min. 1 MΩ
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CP03 (female) (7) – A05 – V02 (female) (1) and chassis ground		Resistance
	3	Defective pump controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.		
			CP03	Travel lever	Voltage
			Between (7) – (3), (13), (23)	At straight-travel	Max. 1 V
	At steering	20 – 30 V			

Circuit diagram related

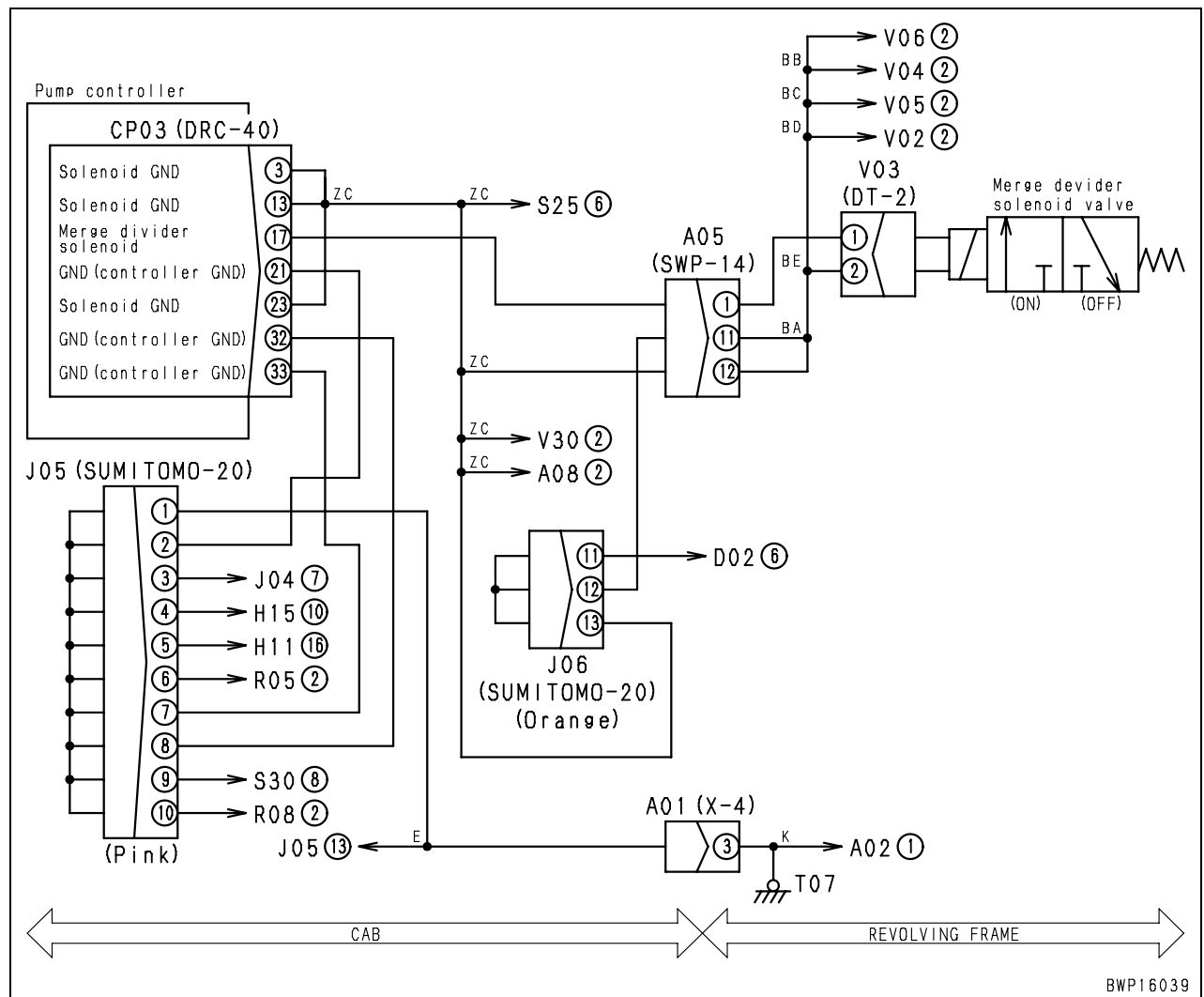


Failure code [DWJ0KA] Merge-divider sol. disc

User code	Failure code	Trouble	Merge-divider solenoid disconnection (Pump controller system)
—	DWJ0KA		
Contents of trouble	• No current flows at output to merge-divider solenoid circuit.		
Action of controller	• None in particular. (Since no current flows, solenoid does not operate.) • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Single operation speed of work equipment and swing is high in lifting mode (L).		
Related information	• Operating condition of merge-divider solenoid (ON/OFF) can be checked with monitoring function. (Code 02300 : Solenoid 1) • Solenoid detects disconnection when output is turned on. To confirm the reproduction after repair, be sure to turn output on. (For more information on how to turn output on/off, see troubleshooting for failure code [DWJ0KB].)		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective merge-divider solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			V03 (male)		Resistance	
			Between (1) – (2)		20 – 60 Ω	
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CP03 (female) (17) – A05 – V03 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between V03 (female) (2) – A05 – CP03 (female) (3), (13), (23) and chassis ground		Resistance	Max. 1 Ω
	3	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between CP03 (female) (17) – A05 – V03 (female) (1) and chassis ground		Voltage	Max. 1 V
	4	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			CP03 (female)		Resistance	
			Between (17) – (3), (13), (23)		20 – 60 Ω	

Circuit diagram related

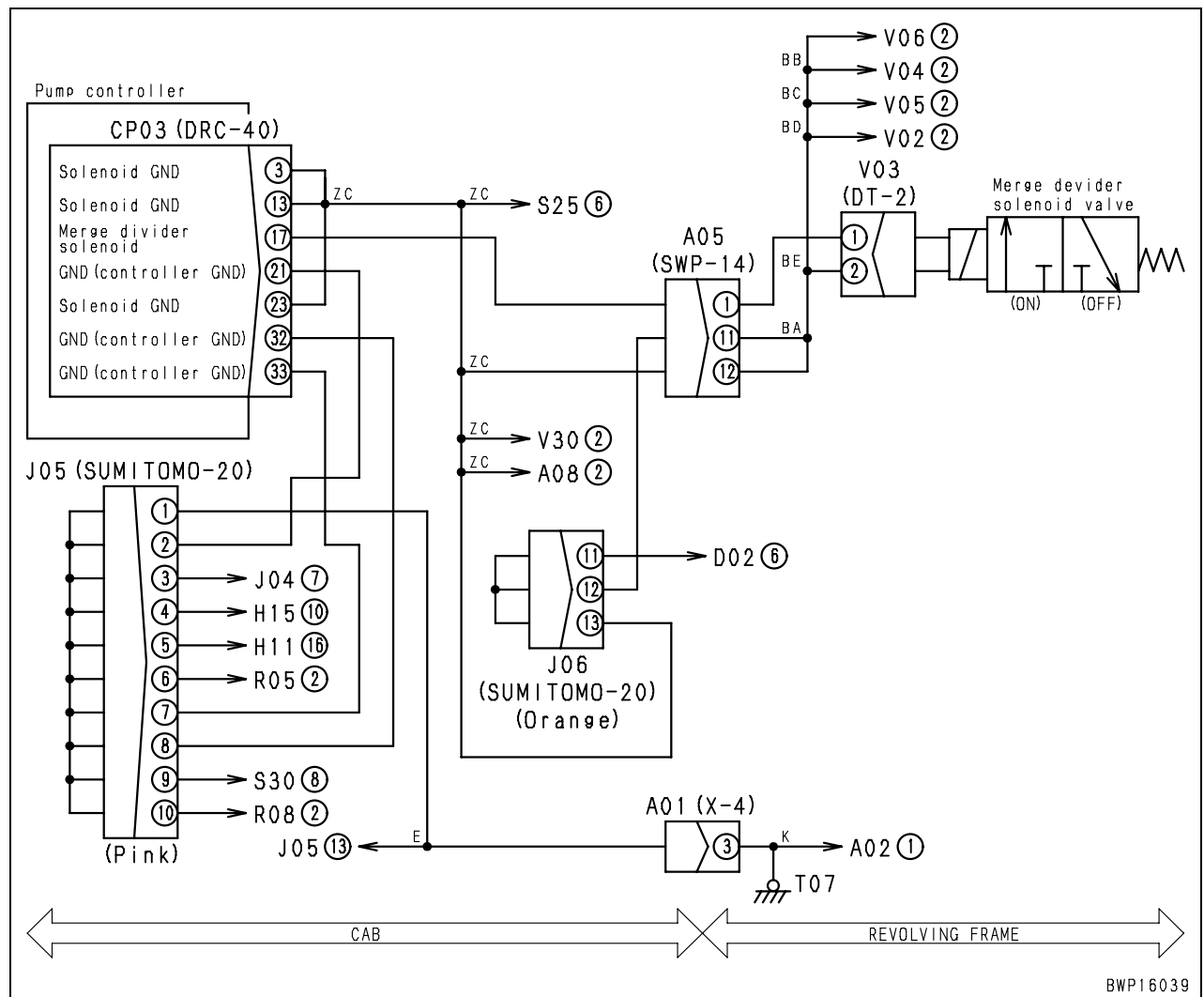


Failure code [DWJ0KB] Merge-divider sol. S/C

User code	Failure code	Trouble	Merge-divider solenoid short (Pump controller system)
—	DWJ0KB		
Contents of trouble	• Abnormal current flowed at output to merge-divider solenoid circuit.		
Action of controller	• Turns output to merge-divider solenoid circuit OFF. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• Single operation speed of work equipment and swing is high in lifting mode (L).		
Related information	• Operating condition of merge-divider solenoid (ON/OFF) can be checked with monitoring function. (Code 02300 : Solenoid 1)		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting				
	1	Defective merge-divider solenoid (Internal short circuit or ground fault)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.				
			V03 (male)		Resistance		
			Between (1) – (2)		20 – 60 Ω		
			Between (1) – chassis ground		Min. 1 MΩ		
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.				
			Wiring harness between CP03 (female) (17) – A05 – V03 (female) (1) and chassis ground		Resistance	Min. 1 MΩ	
	3	Defective pump controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.				
			CP03	Travel lever	Voltage		
			Between (17) – (3), (13), (23)	At neutral		Max. 1 V	
				When either side is operated		20 – 30 V	

Circuit diagram related

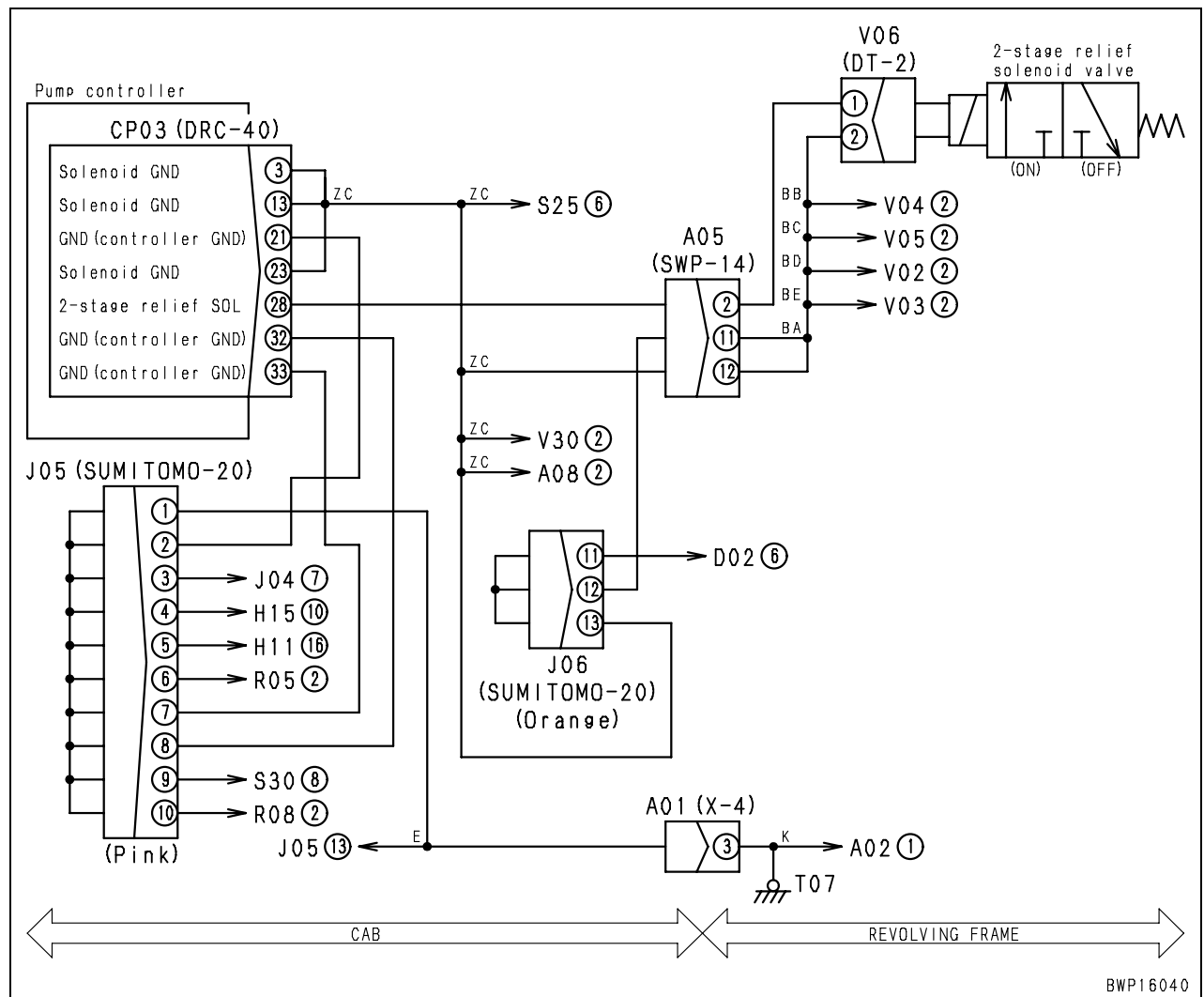


Failure code [DWK0KA] 2-stage relief sol. disc.

User code	Failure code	Trouble	2-stage relief solenoid disconnection (Pump controller system)
—	DWK0KA		
Contents of trouble	• No current flows at output to 2-stage relief solenoid circuit.		
Action of controller	• None in particular. (Since no current flows, solenoid does not operate.) • If cause of failure disappears, system resets itself.		
Problem that appears on machine	• Power maximizing function does not work.		
Related information	• Operating condition of 2-stage relief solenoid (ON/OFF) can be checked with monitoring function. (Code 02300 : Solenoid 1) • Solenoid detects disconnection when output is turned on. To confirm the reproduction after repair, be sure to turn output on. (For more information on how to turn output on/off, see troubleshooting for failure code [DWK0KB].)		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective 2-stage relief solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			V06 (male)		Resistance	
			Between (1) – (2)		20 – 60 Ω	
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CP03 (female) (28) – A05 – V06 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between V06 (female) (2) – A05 – CP03 (female) (3), (13), (23)		Resistance	Max. 1 Ω
	3	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between CP03 (female) (28) – A05 – V06 (female) (1) and chassis ground		Voltage	Max. 1 V
	4	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			CP03 (female)		Resistance	
			Between (28) – chassis ground		20 – 60 Ω	

Circuit diagram related

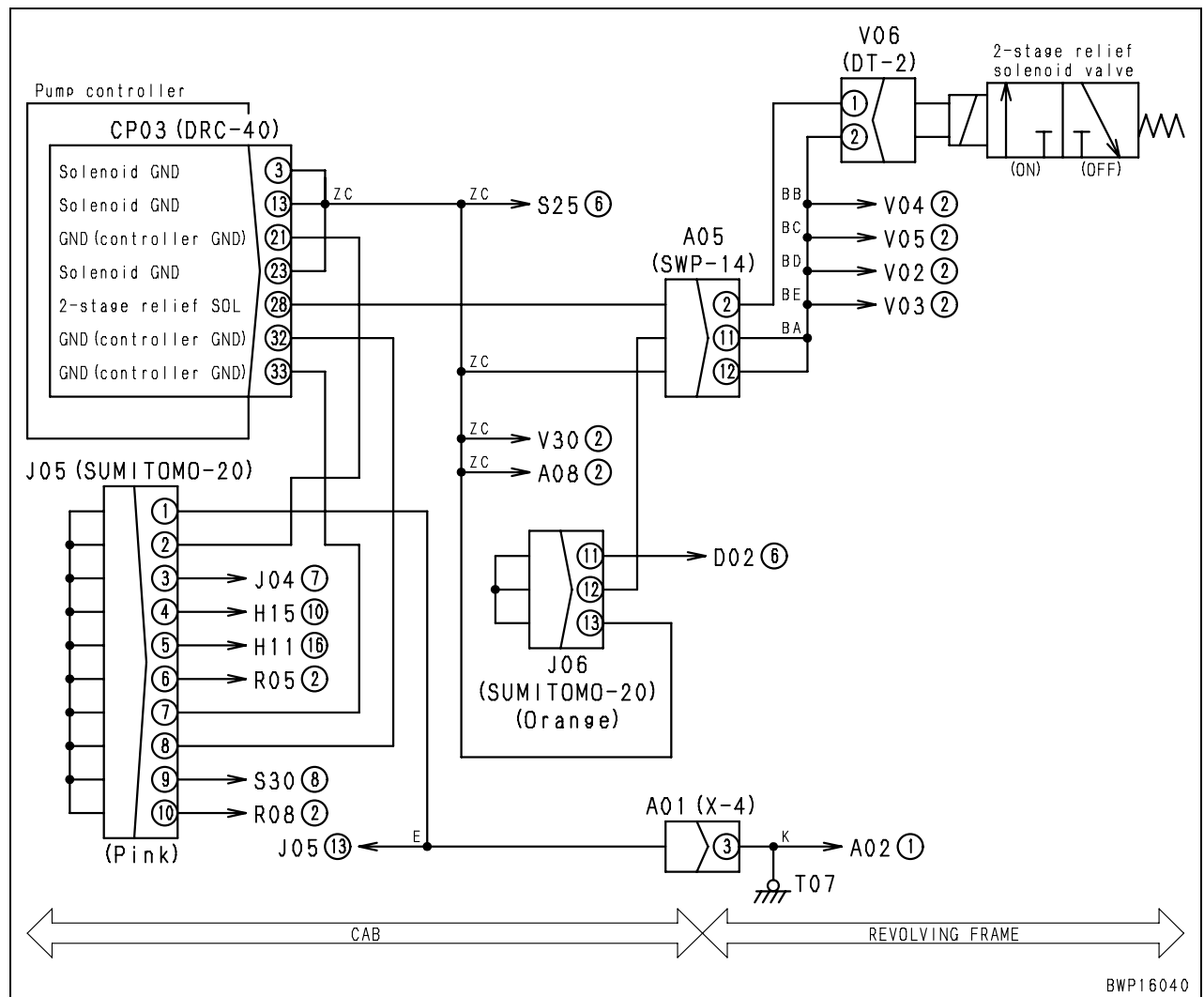


Failure code [DWK0KB] 2-stage relief sol. S/C

User code	Failure code	Trouble	2-stage relief solenoid short (Pump controller system)
—	DWK0KB		
Contents of trouble	• Abnormal current flowed at output to 2-stage relief solenoid circuit.		
Action of controller	• Turns output to 2-stage relief solenoid circuit OFF. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• Power maximizing function does not work.		
Related information	• Operating condition of 2-stage relief solenoid (ON/OFF) can be checked with monitoring function. (Code 02300 : Solenoid 1)		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective 2-stage relief solenoid (Internal short circuit or ground fault)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			V06 (male)		Resistance	
			Between (1) – (2)		20 – 60 Ω	
			Between (1) – chassis ground		Min. 1 MΩ	
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CP03 (female) (28) – A05 – V06 (female) (1) and chassis ground		Resistance	Min. 1 MΩ
	3	Defective pump controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			CP03	Working mode	Voltage	
			Between (28) – chassis ground	When L-mode is not selected	Max. 1 V	
				When L-mode is selected	20 – 30 V	

Circuit diagram related

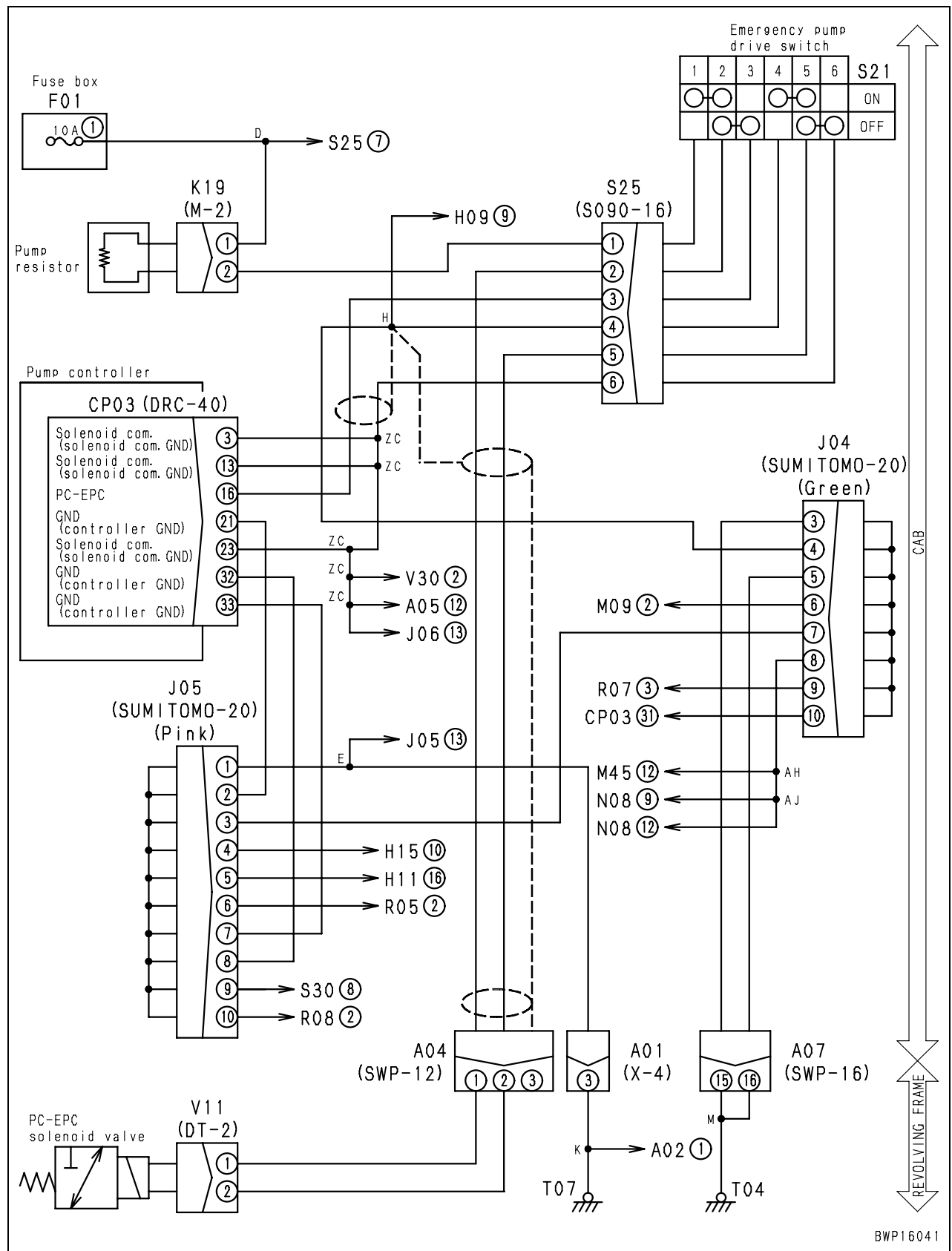


Failure code [DXA0KA] PC-EPC sol. disc.

User code	Failure code	Trouble	PC-EPC solenoid disconnection (Pump controller system)
E02	DXA0KA		
Contents of trouble	<ul style="list-style-type: none"> No current flows to PC-EPC solenoid circuit. 		
Action of controller	<ul style="list-style-type: none"> None in particular. (Since no current flows, solenoid does not operate.) If cause of failure disappears, system resets itself. 		
Problem that appears on machine	<ul style="list-style-type: none"> If pump load increases, engine speed lowers largely and engine may stall. 		
Related information	<ul style="list-style-type: none"> Output to PC-EPC solenoid (current value) can be checked with monitoring function. (Code 01300: PC-EPC solenoid current) If solenoid and wiring harness are not defective, turn emergency drive switch on; the operator can operate the machine with output equivalent to E-mode. (Failure code [DXA0KA] is then displayed, but it is not defective.) 		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective PC-EPC solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			V11 (male)		Resistance	
			Between (1) – (2)		7 – 14 Ω	
	2	Defective emergency pump drive switch (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S21	Switch	Resistance	
			Between (2) – (3)	OFF	Max. 1 Ω	
				ON	Min. 1 MΩ	
			Between (5) – (6)	OFF	Max. 1 Ω	
				ON	Min. 1 MΩ	
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CP03 (female) (16) – S25 (3)		Resistance	Max. 1 Ω
			Wiring harness between S25 (2) – A04 – V11 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between S25 (5) – A04 – V11 (female) (2)		Resistance	Max. 1 Ω
	4	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between CP03 (female) (16) – S25 (3) and chassis ground		Voltage	Max. 1 V
			Wiring harness between S25 (2) – A04 – V11 (female) (1) and chassis ground		Voltage	Max. 1 V
	5	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			CP03 (female)		Resistance	
Between (16) – (3), (13), (23)			7 – 14 Ω			

Circuit diagram related

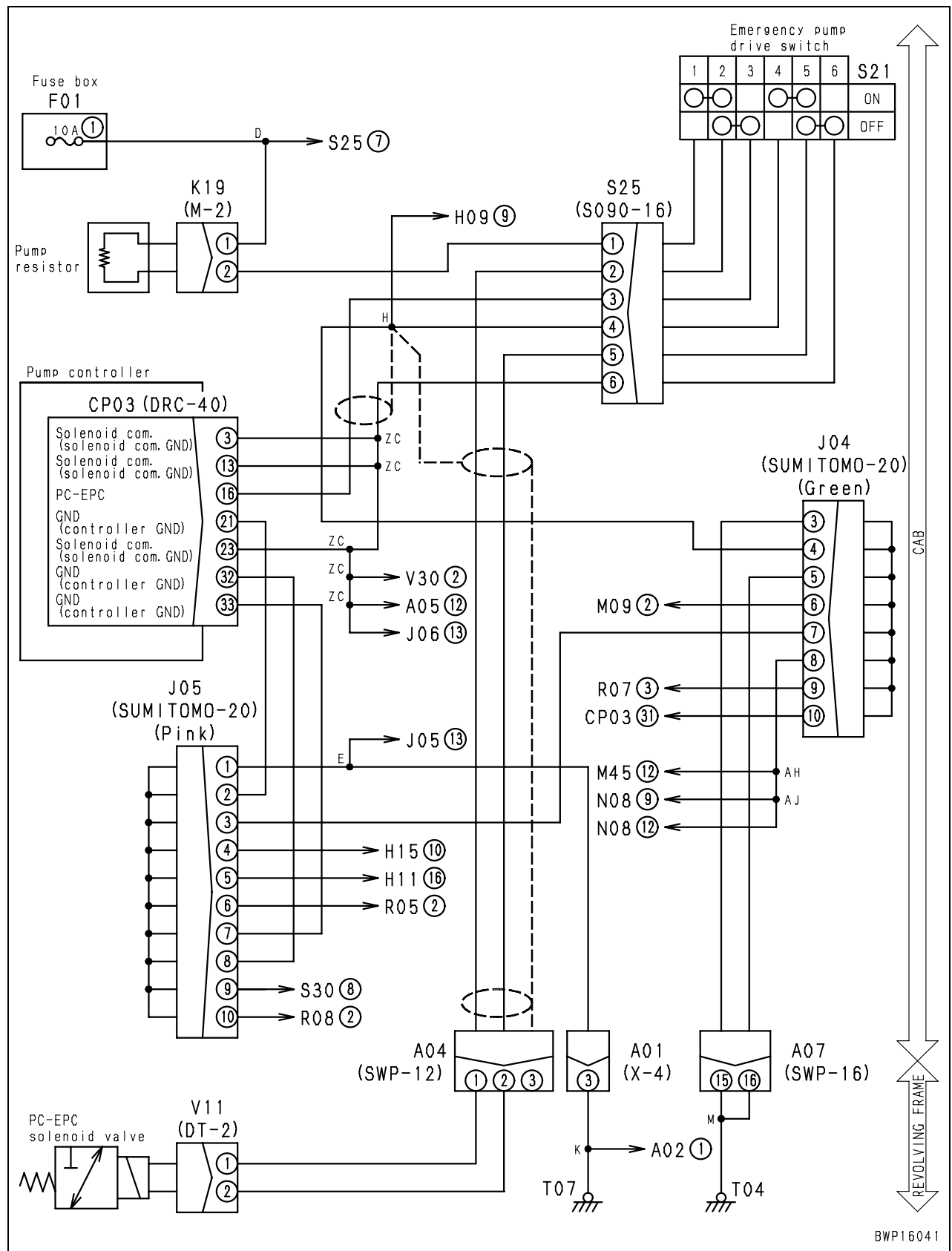


Failure code [DXA0KB] PC-EPC sol. S/C

User code	Failure code	Trouble	PC-EPC solenoid short (Pump controller system)
E02	DXA0KB		
Contents of trouble	• Abnormal current flowed to PC-EPC solenoid circuit.		
Action of controller	• Sets output to PC-EPC solenoid circuit to 0. • Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF.		
Problem that appears on machine	• If pump load increases, engine speed lowers largely and engine may stall.		
Related information	• Output to PC-EPC solenoid (current value) can be checked with monitoring function. (Code 01300 : PC-EPC solenoid current) • If solenoid and wiring harness are not defective, turn emergency drive switch on; the operator can operate the machine with output equivalent to E-mode. (Failure code [DXA0KA] is then displayed, but it is not defective.) ★ Turn emergency pump drive switch OFF during troubleshooting.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective PC-EPC solenoid (Internal short circuit or ground fault)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			V11 (male)		Resistance
			Between (1) – (2)		7 – 14 Ω
			Between (1) – chassis ground		Min. 1 MΩ
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CP03 (female) (16) – S25 – V11 (female) (1) and chassis ground		Resistance
	3	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			CP03 (female)		Resistance
			Between (16) – (3), (13), (23)		7 – 14 Ω
Between (16) – chassis ground			Min. 1 MΩ		

Circuit diagram related

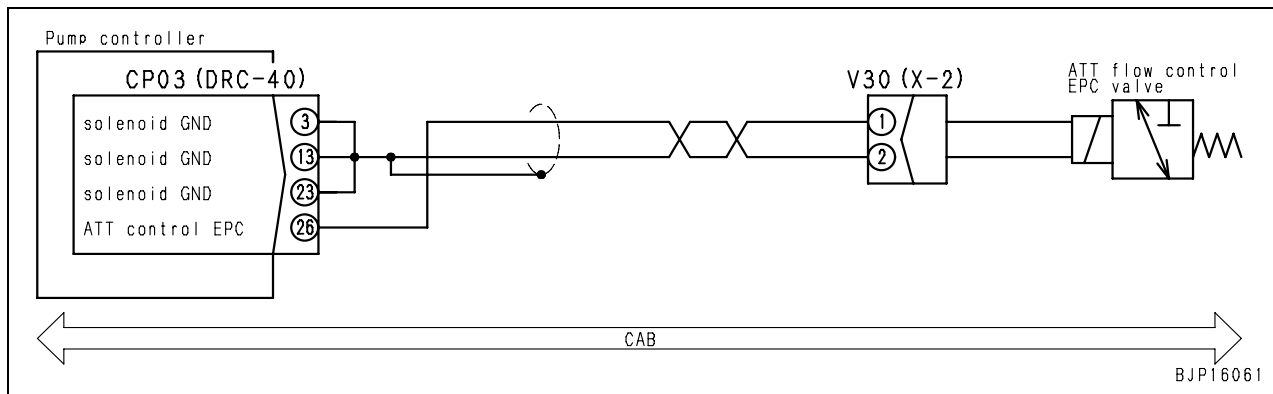


Failure code [DXE4KA] Service current EPC disc.

User code	Failure code	Trouble	Service current EPC solenoid disconnection (Pump controller system)
—	DXE4KA		
Contents of trouble	<ul style="list-style-type: none"> No current flows to service current EPC solenoid circuit. 		
Action of controller	<ul style="list-style-type: none"> None in particular. (Since no current flows, solenoid does not operate.) If cause of failure disappears, system resets itself. 		
Problem that appears on machine	<ul style="list-style-type: none"> Attachment does not move. 		
Related information	<ul style="list-style-type: none"> Carry out troubleshooting only for setting with ATT. (Confirm settings on the machine monitor.) Output to service current EPC solenoid (current value) can be checked with monitoring function. (Code 01700: Service solenoid current) 		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective service current EPC solenoid (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			V30 (male)		Resistance	
			Between (1) – (2)		7 – 14 Ω	
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CP03 (female) (26) – V30 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between CP03 (female) (3), (13), (23) – V30 (female) (2)		Resistance	Max. 1 Ω
	3	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between CP03 (female) (26) – V30 (female) (1) and chassis ground		Voltage	Max. 1 V
	4	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			CP03 (female)		Resistance	
			Between (26) – (3), (13), (23)		7 – 14 Ω	

Circuit diagram related

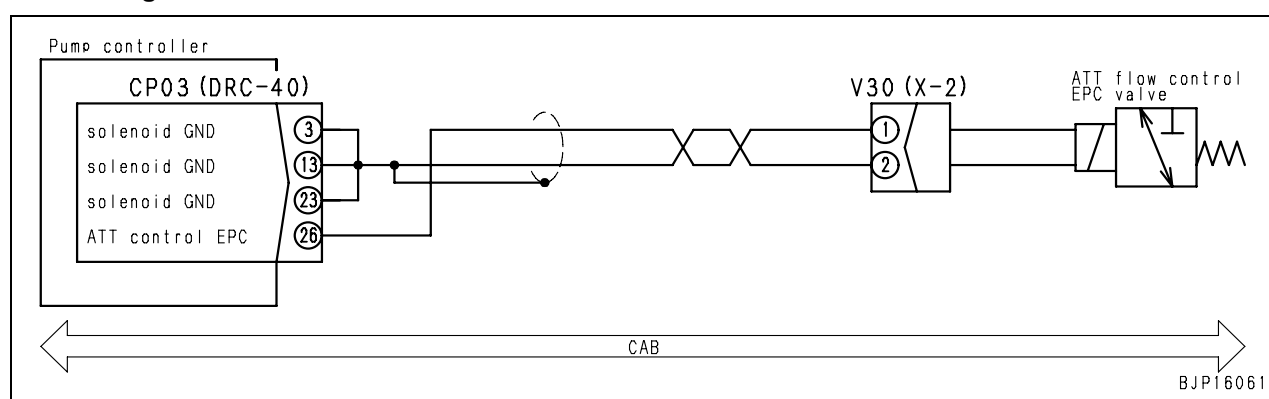


Failure code [DXE4KB] Service current EPC S/C

User code	Failure code	Trouble	Service current EPC solenoid short (Pump controller system)
—	DXE4KB		
Contents of trouble	<ul style="list-style-type: none"> Abnormal current flowed to service current EPC solenoid circuit. 		
Action of controller	<ul style="list-style-type: none"> Sets output to service current EPC solenoid circuit to 0. Even if cause of failure disappears, system does not reset itself until starting switch is turned OFF. 		
Problem that appears on machine	<ul style="list-style-type: none"> Attachment does not move. 		
Related information	<ul style="list-style-type: none"> Carry out troubleshooting only for setting with ATT. (Confirm settings on the machine monitor.) Output to service current EPC solenoid (current value) can be checked with monitoring function. (Code 01700: Service solenoid current) 		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective service current EPC solenoid (Internal short circuit or ground fault)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			V30 (male)		Resistance	
			Between (1) – (2)		7 – 14 Ω	
			Between (1) – chassis ground		Min. 1 MΩ	
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CP03 (female) (26) – V30 (female) (1) and chassis ground		Resistance	Min. 1 MΩ
	3	Defective pump controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			CP03 (female)		Resistance	
			Between (26) – (3), (13), (23)		7 – 14 Ω	
			Between (26) – chassis ground		Min. 1 MΩ	

Circuit diagram related

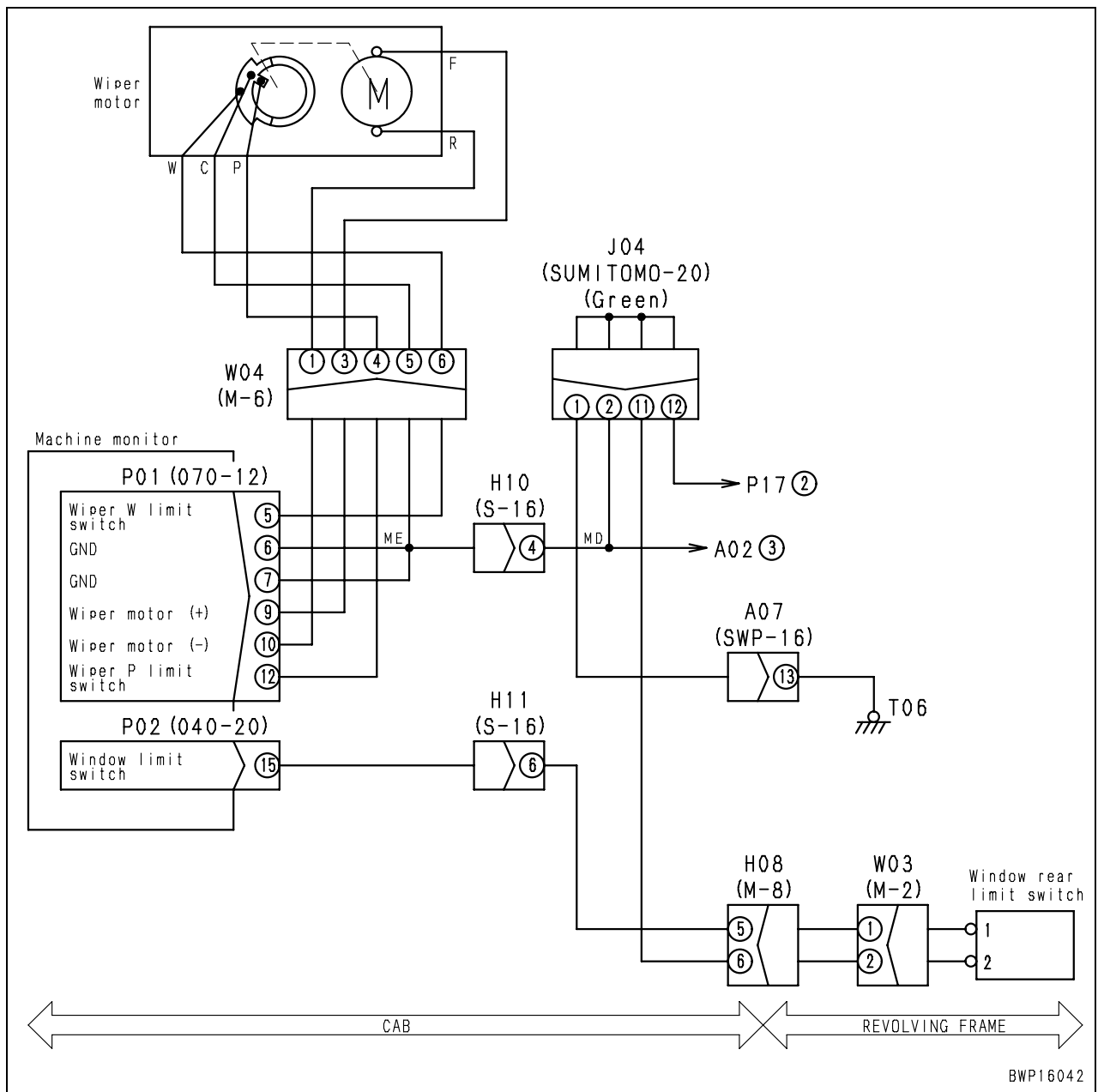


Failure code [DY20KA] Wiper working abnormality

User code	Failure code	Trouble	Wiper working abnormality (Machine monitor system)
—	DY20KA		
Contents of trouble	• When windshield wiper works, W signal of working ends is not input.		
Action of machine monitor	• Turns working output to wiper motor OFF.		
Problem that appears on machine	• Windshield wiper does not operate.		
Related information	• Input of W signal in wiper working area (ON/OFF) can be checked with monitoring function. (Code 04502 : Monitor Input 3)		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective wiper motor (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			W04 (female)	Wiper blade	Resistance	
			Between (6) – (5)	Operating range top	Max. 1 Ω	
				Other than operating range top	Min. 1 MΩ	
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between P01 (female) (5) – W04 (male) (6)		Resistance	Max. 1 Ω
			Wiring harness between W04 (male) (5) – chassis ground		Resistance	Max. 1 Ω
	3	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			P01	Wiper blade	Voltage	
			Between (5) – chassis ground	Operating range top	Max. 1 V	
				Other than operating range top	20 – 30 V	

Circuit diagram related

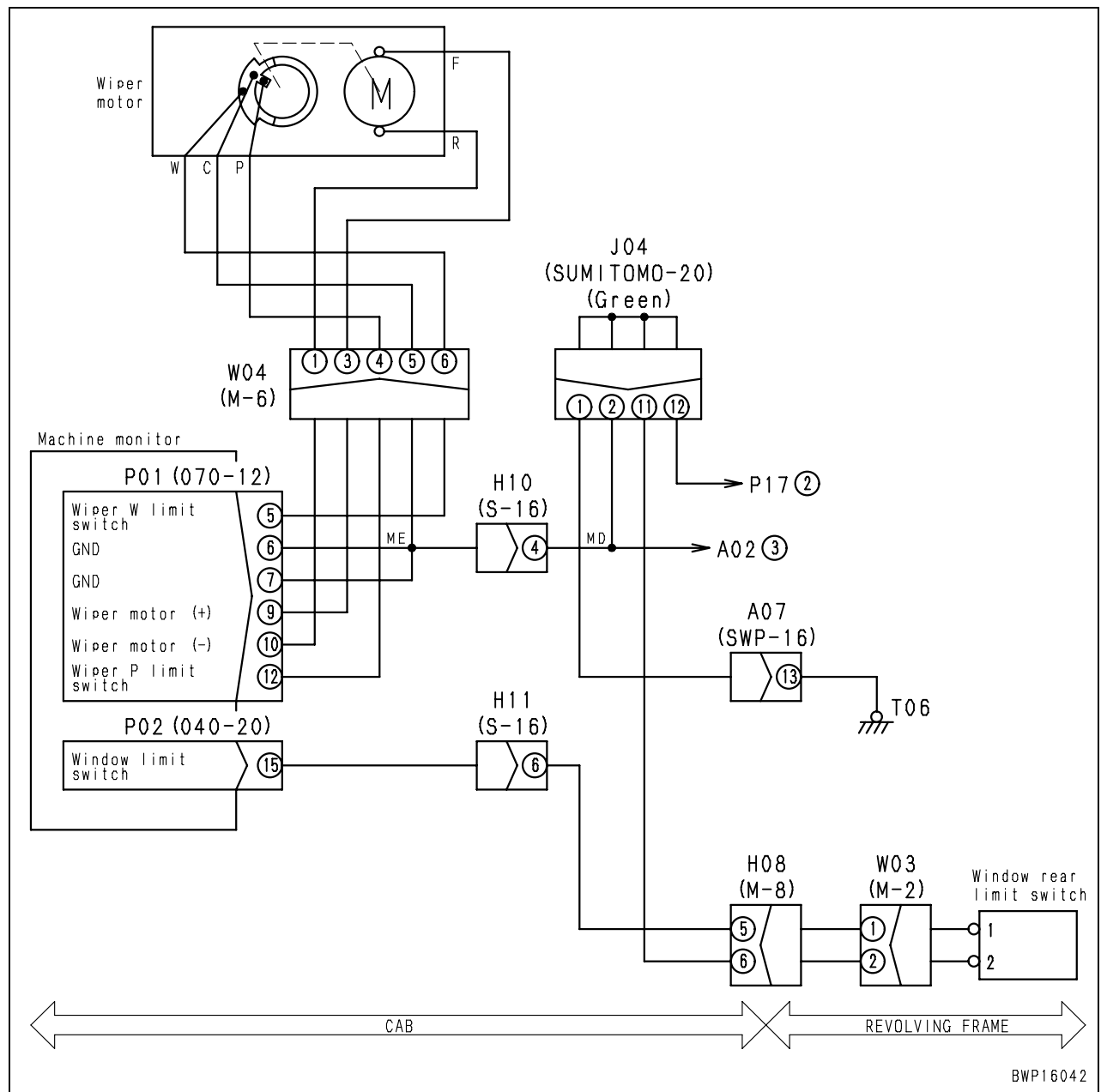


Failure code [DY20MA] Wiper parking abnormality

User code	Failure code	Trouble	Wiper parking abnormality (Machine monitor system)
—	DY20MA		
Contents of trouble	• When windshield wiper parks, P signal of storage area is not input.		
Action of machine monitor	• Turns parking output to wiper motor OFF.		
Problem that appears on machine	• Windshield wiper does not park.		
Related information	• Input of P signal in wiper parking area (ON/OFF) can be checked with monitoring function. (Code 04502 : Monitor Input 3)		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective wiper motor (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			W04 (female)	Wiper blade	Resistance	
			Between (4) – (5)	Storage area	Max. 1 Ω	
				Working area	Min. 1 MΩ	
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between P01 (female) (12) – W04 (male) (4)		Resistance	Max. 1 Ω
			Wiring harness between W04 (female) (5) – chassis ground		Resistance	Max. 1 Ω
	3	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			P01	Wiper blade	Voltage	
			Between (12) – chassis ground	Storage area	Max. 1 V	
				Working area	20 – 30 V	

Circuit diagram related

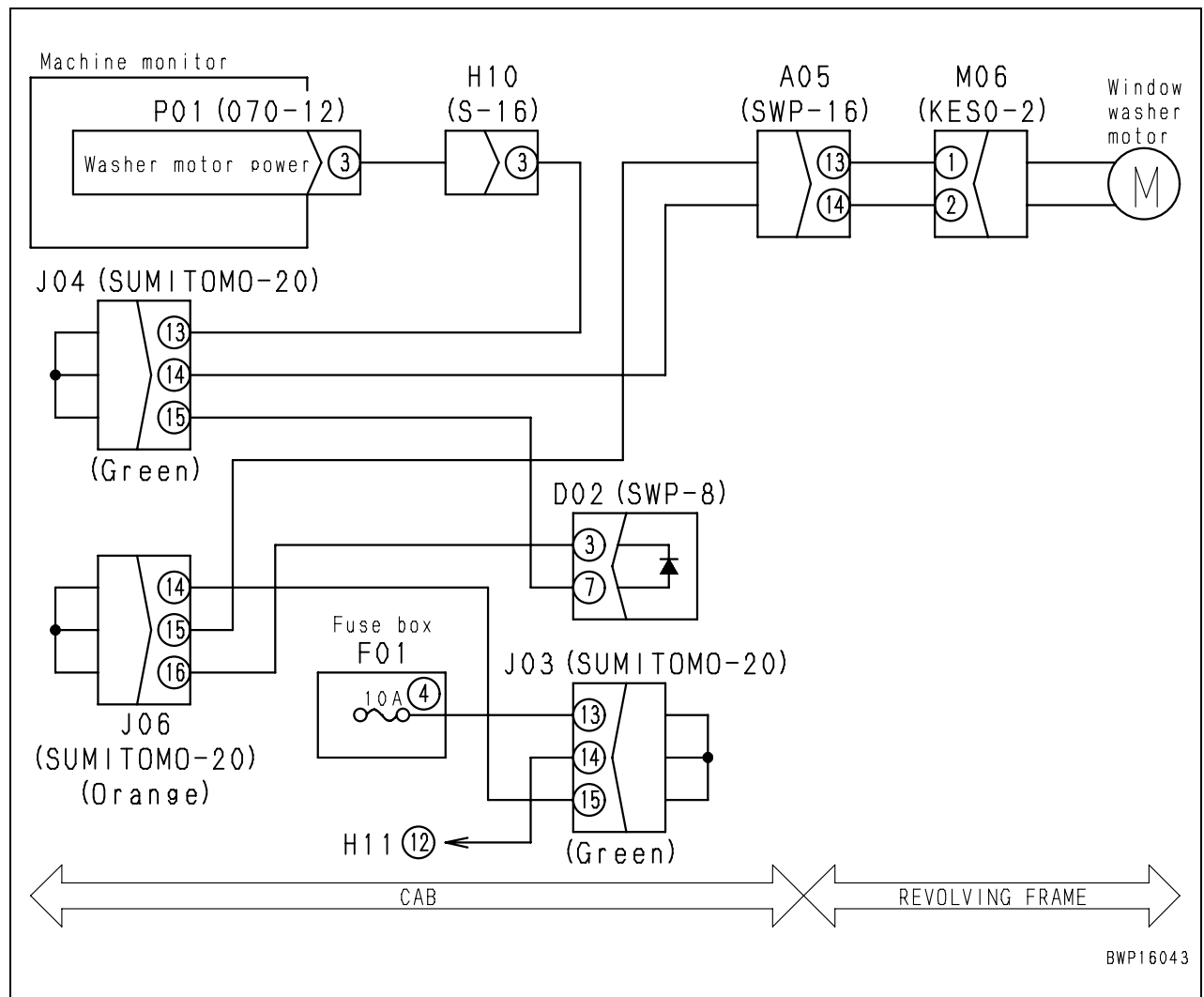


Failure code [DY2CKB] Washer drive S/C

User code	Failure code	Trouble	Window washer drive system short (Machine monitor system)
—	DY2CKB		
Contents of trouble	• When washer drive circuit was connected to GND (when output was turned ON), abnormal current flowed.		
Action of machine monitor	• Turns output to washer motor circuit OFF.		
Problem that appears on machine	• Window washer operation stops.		
Related information			

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective washer motor (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			M06 (male)		Resistance	
			Between (1) – (2)		5 – 20 Ω	
	2	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harnesses between P01 (female) (3) – H10 – J04 – A05 – M06 (female) (2), – D02 (female) (7) and chassis ground		Voltage	Max. 1 V
	3	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			P01	Washer switch	Voltage	
			Between (3) – chassis ground	OFF	20 – 30 V	
				ON	Max. 1 V	

Circuit diagram related

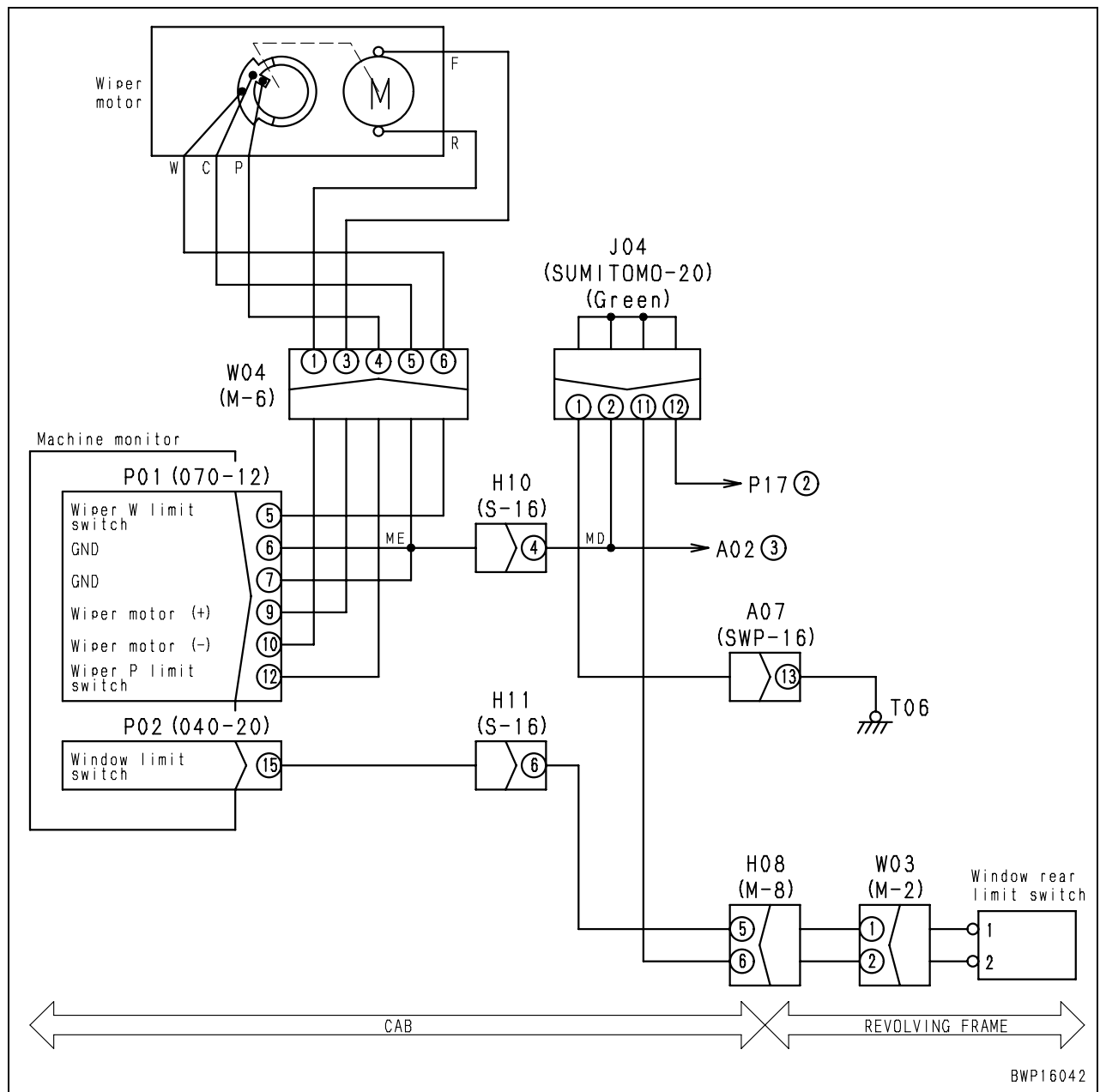


Failure code [DY2DKB] Wiper drive (for) S/C

User code	Failure code	Trouble	Wiper motor drive forward system short (Machine monitor system)
—	DY2DKB		
Contents of trouble	• Abnormal current flowed at output to wiper motor drive forward circuit.		
Action of machine monitor	• Turns output to wiper motor drive forward circuit OFF.		
Problem that appears on machine	• Window washer operation stops.		
Related information			

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective wiper motor (Internal short circuit or ground fault)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			W04 (female)		Continuity/Resistance
			Between (3) – (1)		There is continuity
			Between (3) – chassis ground		Min. 1 MΩ
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between P01 (female) (9) – W04 (male) (3) and chassis ground		Resistance
	3	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			P01	Wiper switch	Voltage
			Between (9) – chassis ground	OFF	Max. 3 V
				ON	Max. 3 V ⇔ 20 – 30 V (Constant cycle)

Circuit diagram related

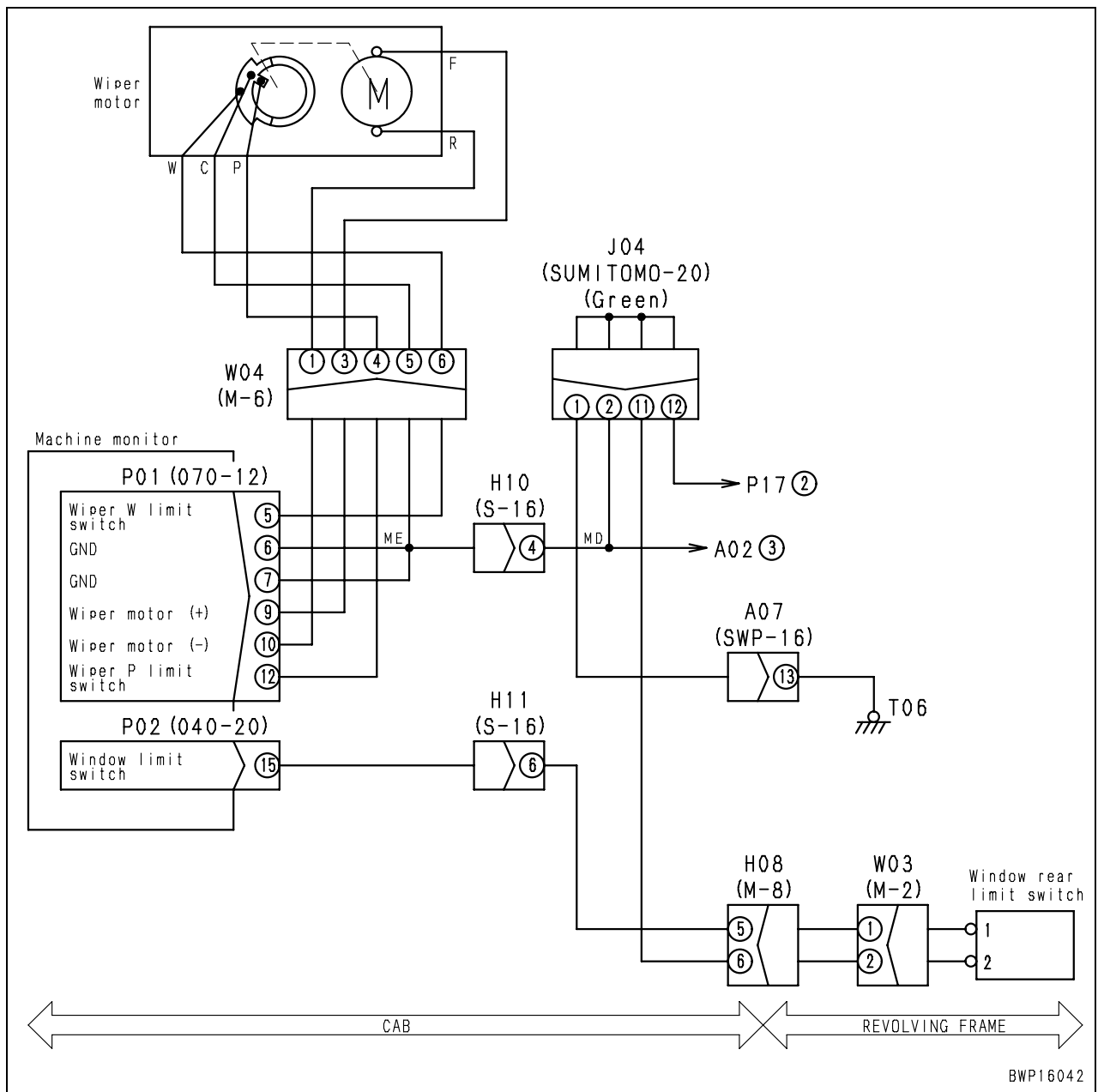


Failure code [DY2EKB] Wiper drive (rev) S/C

User code	Failure code	Trouble	Wiper motor drive reverse system short (Machine monitor system)
—	DY2EKB		
Contents of trouble	• Abnormal current flowed at output to wiper motor drive reverse circuit.		
Action of machine monitor	• Turns output to wiper motor drive reverse circuit OFF.		
Problem that appears on machine	• Window washer operation stops.		
Related information			

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective wiper motor (Internal short circuit or ground fault)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			W04 (female)		Continuity/Resistance	
			Between (1) – (3)		There is continuity	
			Between (1) – chassis ground		Min. 1 MΩ	
	2	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between P01 (female) (10) – W04 (male) (1) and chassis ground		Resistance	Min. 1 MΩ
	3	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			P01	Wiper switch	Voltage	
			Between (10) – chassis ground	OFF	Max. 3 V	
				ON	Max. 3 V ⇔ 20 – 30 V (Constant cycle)	

Circuit diagram related



PC160LC-7E0, PC180LC/NLC-7E0 Hydraulic excavator

Form No. UEN02116-00

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HYDRAULIC EXCAVATOR

PC160LC-7E0

PC180LC-7E0

PC180NLC-7E0

Machine model Serial number

PC160LC-7E0	K45001 and up
PC180LC-7E0	K45001 and up
PC180NLC-7E0	K45001 and up

40 Troubleshooting

Troubleshooting of electrical system (E-mode)

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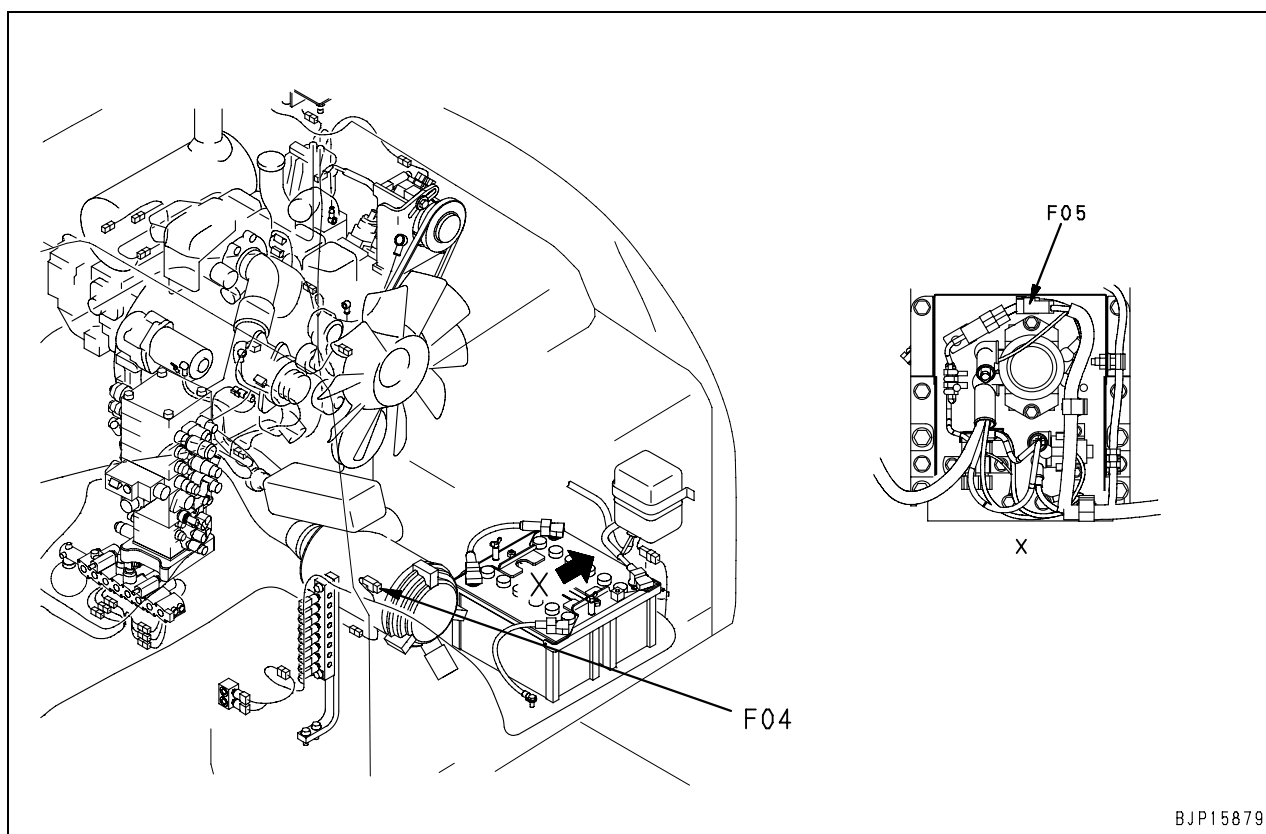
Before carrying out troubleshooting of electrical system

Connection table of fuse box

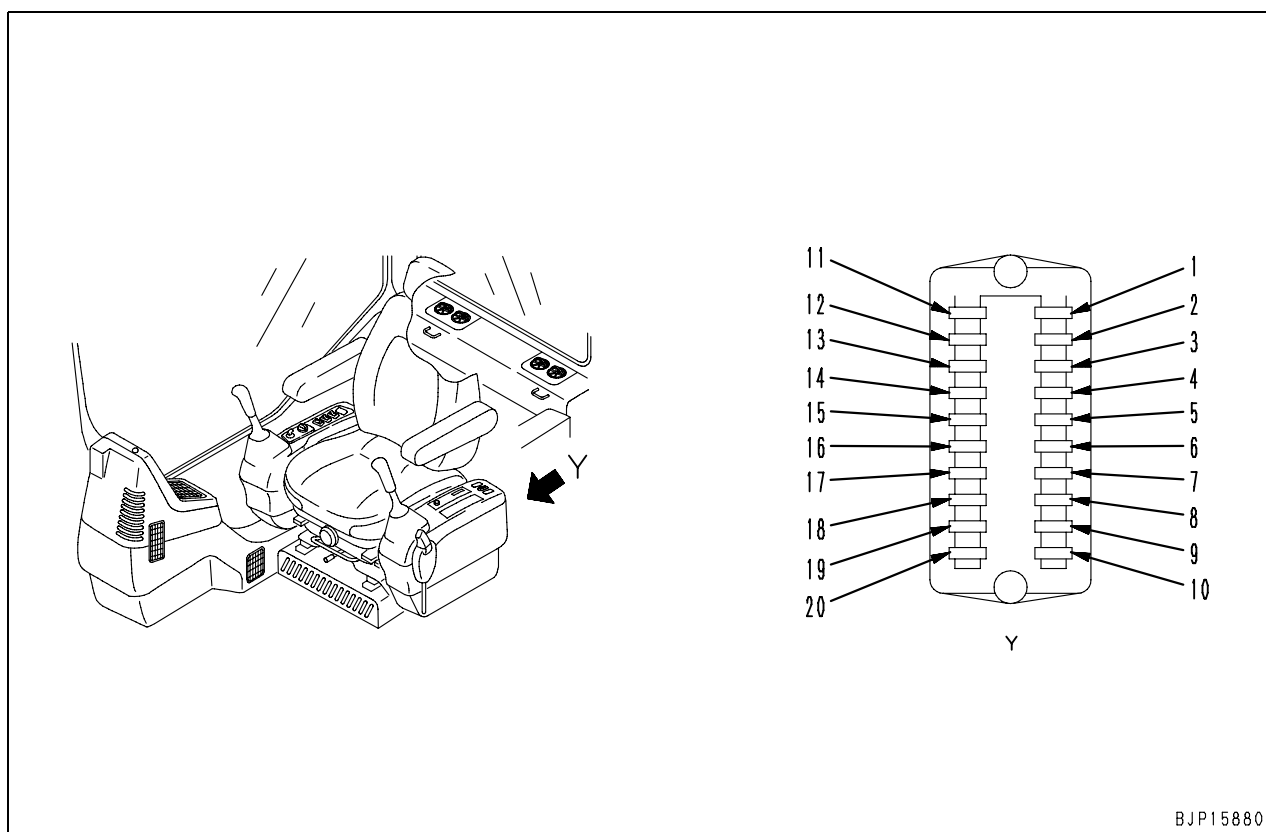
- ★ This connection table shows the devices to which each power supply of the fuse box supplies power (A switch power supply is a device which supplies power while the starting switch is in the ON position and a constant power supply is a device which supplies power while the starting switch is in the OFF and ON positions).
- ★ When carrying out troubleshooting related to the electrical system, you should check the fuses and fusible links to see if the power is supplied normally.

Type of power supply	Fusible link	Fuse No.	Fuse capacity	Destination of power
Switch power supply	F04 (65A)	1	10A	Swing parking brake release switch
				Emergency pump resistor
		2	20A	Pump controller (Solenoid power supply)
				Starting motor cut-out relay (PPC lock)
		3	20A	Machine monitor
				Wiper motor
Switch power supply	F04 (65A)	4	10A	Cigarette lighter
				Windshield washer motor
		5	10A	Horn switch
				Relay for auto preheat
		6	10A	Lower wiper
				Rotary lamp
Switch power supply	F04 (65A)	7	10A	Right headlamp, working lamp (boom), working lamp (rear)
				Radio
		8	10A	Left knob switch (pump controller input)
				Refuel pump
		9	10A	Revo work lamp
				Air conditioner unit
Switch power supply	F04 (65A)	10	10A	Air conditioner compressor relay
				Air conditioner blower relay
		11	20A	(Spare)
				Lamp switch
		12	20A	Optional power supply (1)
				Travel alarm
Constant power supply	F05 (30A)	13	10A	Optional power supply (2)
				Radio (backup power supply)
		14	10A	Cab lamp
				12v power supply
		15	20A	Starting switch (B)
				Machine monitor
Switch power supply	Starting switch ACC	16	20A	Pump controller
				(Spare)
		17	30A	Engine controller
Switch power supply	Starting switch ACC	18	10A	Engine controller (ACC signal)
		19	5A	

Locations of fusible links



Location of fuse box and fuse Nos.



Information contained in troubleshooting table

- ★ Troubleshooting Table and Related Circuit Diagram collectively carry the following information. Carry out troubleshooting work after fully grasping their contents.

Trouble	Phenomenon occurring on machine
Relative information	Information on the failure occurred as well as the troubleshooting

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Possible causes of trouble (Given numbers are reference numbers, which do not indicate priority)	<Contents of description> <ul style="list-style-type: none"> Standard value in normal state to judge possible causes Remarks on judgment
	2		<Troubles in wiring harness> <ul style="list-style-type: none"> Disconnection Connector is connected imperfectly or wiring harness is broken. Ground fault Wiring harness which is not connected to chassis ground circuit is in contact with chassis ground circuit. Hot short Wiring harness which is not connected to power source (24 V) circuit is in contact with power source (24 V) circuit. Short circuit Independent wiring harnesses are in contact with each other abnormally.
	3		<Precautions for troubleshooting> <p>(1) Method of indicating connector No. and handling of T-adaptor Insert or connect T-adaptor as explained below for troubleshooting, unless otherwise specified.</p> <ul style="list-style-type: none"> If connector No. has no marks of “male” and “female”, disconnect connector and insert T-adapters in both male side and female side. If connector No. has marks of “male” and “female”, disconnect connector and connect T-adaptor to only male side or female side.
	4		<p>(2) Entry order of pin Nos. and handling of tester leads Connect positive (+) lead and negative (–) lead of tester as explained below for troubleshooting, unless otherwise specified.</p> <ul style="list-style-type: none"> Connect positive (+) lead to pin No. or wiring harness entered on front side. Connect negative (–) lead to pin No. or harness entered on rear side.

Relative Electrical Circuit Diagram

<p>This is part of the electrical circuit diagram which shows the portion where the failure occurred.</p> <ul style="list-style-type: none"> Connector No.: Indicates (Type – numbers of a pin) (colour) Arrow : Roughly indicates the location in the machine where it is installed.

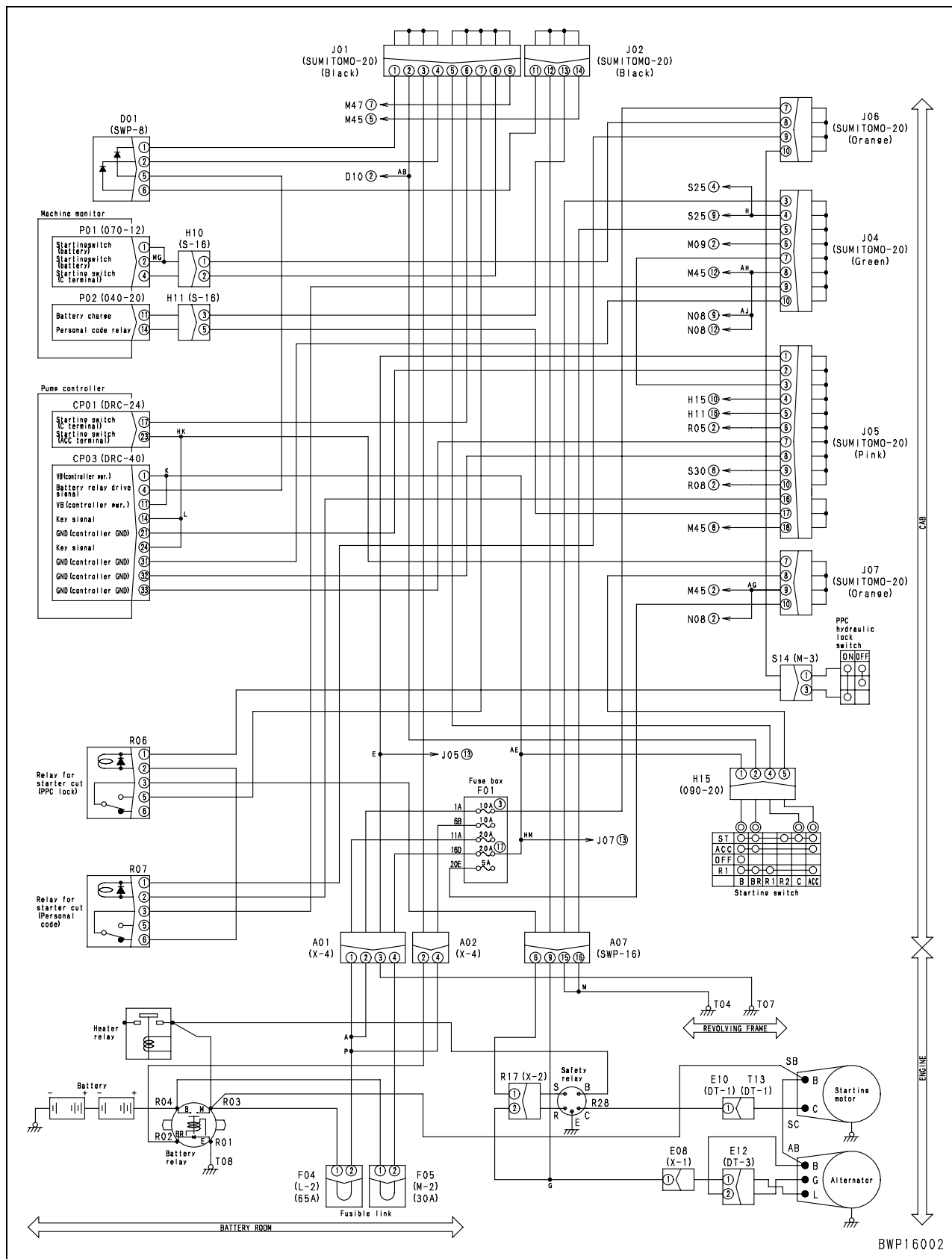
E-1 Engine does not start

Trouble	<ul style="list-style-type: none"> Engine does not start (Engine does not turn).
Related information	<ul style="list-style-type: none"> Engine starting circuit has following 2 start lock mechanisms: <ol style="list-style-type: none"> 1) Start lock by the machine monitor password 2) Start lock by the lock lever In the case no failure code for the engine controller mechanism is indicated

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Low charge level of battery	Battery voltage		Specific gravity of battery	
			Min. 24 V		Min. 1.26	
	2	Defective fuse No. 3, No. 17 or fusible link F04 and F05	If fuse or fusible link is burnt out, the circuit probably has ground fault. In the case the machine monitor does not light up, check the power circuit between the battery and the fuse.			
	3	Defective starting switch (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			H15 (male)	Position	Resistance	
			Between (1) – (4)	OFF	Min. 1 MΩ	
				START	Max. 1 Ω	
	4	Defective lock switch (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S14 (female)	Lock lever	Resistance	
			Between (1) – (3)	Free	Min. 1 MΩ	
				Lock	Max. 1 Ω	
	5	Defective starting motor cut-out relay R06 or R07 (Internal short circuit or ground fault)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			R06 (female), R07 (female)		Resistance	
			Between (1) – (2)		100 – 500 Ω	
			Between (3) – (5)		Min. 1 MΩ	
			Between (3) – (6)		Max. 1 Ω	
	6	Defective starting motor (Internal disconnection or breakage)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting. (If power supply and starting input and output are normal but starting motor does not turn, starting motor is defective.)			
			Starting motor		Starting switch	Voltage
			Power supply: Between terminal B and chassis ground		When started	20 – 30 V
			Starting input: Terminal C – chassis ground			20 – 30 V
	7	Defective alternator (Internal short circuit)	★ Prepare with starting switch OFF, then turn starting switch ON or start engine and carry out troubleshooting.			
			Alternator		Voltage	
Terminal L – chassis ground			Max. 1 V			

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	8	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between F01(17) outlet – H15 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between H15 (female) (4) – J01 – R06 (female) (5)	Resistance	Max. 1 Ω
			Wiring harness between R06 (female) (3) – A07 – R17 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between F01(3) outlet – J06 – S14 (male) (1)	Resistance	Max. 1 Ω
			Wiring harness between S14 (male) (3) – R06 (female) (1)	Resistance	Max. 1 Ω
			Wiring harness between R06 (female) (2) – R07 (female) (6)	Resistance	Max. 1 Ω
			Wiring harness between R07 (female) (3) – J04 – A07 – chassis ground	Resistance	Max. 1 Ω
	9	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between battery relay terminal B (R04) – F05 – A01 – F01(17) inlet and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between F01(17) outlet – H15 (female) (1) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between H15 (female) (4) – J01 – R06 (female) (5) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between R06 (female) (3) – A07 – R17 (female) (1) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between F01(3) outlet – J06 – S14 (female) (1) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between S14 (female) (3) – R06 (female) (1) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between R07 (female) (2) – J05 – H11 – P02 (female) (14) and chassis ground	Resistance	Min. 1 MΩ
	10	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between P02 (female) (11) – H11 – J02 – A07 – R17 (female) (2), – D01 (female) (6), – alternator terminal L and chassis ground	Voltage	Max. 1 V
	11	Defective power supply of engine controller	Power supply of engine controller may be defective. Carry out troubleshooting for failure code [CA757].		

Circuit diagram related



E-2 Auto-decelerator does not operate

Trouble	<ul style="list-style-type: none"> Auto-decelerator does not operate.
Related information	<ul style="list-style-type: none"> Set speed of auto-decelerator is 1,300 rpm. Accordingly, set the fuel control dial to a higher rpm than this speed. If set speed is under 1,300 rpm, the auto-decelerator will not operate. Check all the monitoring indications after starting the engine.

	Cause		Standard value in normal state/Remarks on troubleshooting		
			Monitoring code	Item	Normal display
Possible causes and standard value in normal state	1	Defective boom RAISE signal	In the case monitoring is not normally indicated, proceed to troubleshooting No. E-17.		
			01900	Boom RAISE	Operation of lever: ON Lever in neutral: OFF
	2	Defective boom LOWER signal	In the case monitoring is not normally indicated, proceed to troubleshooting No. E-18.		
			01900	Boom LOWER	Operation of lever: ON Lever in neutral: OFF
	3	Defective arm IN signal	In the case monitoring is not normally indicated, proceed to troubleshooting No. E-19.		
			01900	Arm IN	Operation of lever: ON Lever in neutral: OFF
	4	Defective arm OUT signal	In the case monitoring is not normally indicated, proceed to troubleshooting No. E-20.		
			01900	Arm OUT	Operation of lever: ON Lever in neutral: OFF
	5	Defective bucket CURL signal	In the case monitoring is not normally indicated, proceed to troubleshooting No. E-21.		
			01901	Bucket CURL	Operation of lever: ON Lever in neutral: OFF
	6	Defective bucket DUMP signal	In the case monitoring is not normally indicated, proceed to troubleshooting No. E-22.		
			01901	Bucket DUMP	Operation of lever: ON Lever in neutral: OFF
	7	Defective swing signal	In the case monitoring is not normally indicated, proceed to troubleshooting No. E-23, E-24.		
			01900	Swing	Operation of lever: ON Lever in neutral: OFF

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	8	Defective travel signal	In the case monitoring is not normally indicated, proceed to troubleshooting No. E-25.		
			Monitoring code	Item	Normal display
			01900	Travel	Operation of lever: ON Lever in neutral: OFF
	9	Defective attachment signal	In the case monitoring is not normally indicated, proceed to troubleshooting No. E-27.		
			Monitoring code	Item	Normal display
			01901	Service	Operation of lever: ON Lever in neutral: OFF
	10	Defective pump controller	Since trouble is in system, troubleshooting cannot be carried out. (If causes 1 – 9 above are not detected, engine controller may be defective.)		

E-3 Automatic warming-up system does not operate

Trouble	<ul style="list-style-type: none"> Automatic warming-up system does not operate
Related information	<ul style="list-style-type: none"> When engine coolant temperature is below 30°C, automatic warm-up system raises engine speed to 1,250 rpm. If fuel control dial is opened more than 70% for 3 seconds or longer when starting switch is turned ON or after engine is started, automatic warm-up system is turned OFF.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective engine coolant temperature signal	In the case monitoring is not normally indicated, proceed to troubleshooting No. E-11.		
			Monitoring code	Item	Normal display
			04105	Engine coolant temperature	Compare with actual engine coolant temperature
	2	Defective pump controller	Since trouble is in system, troubleshooting cannot be carried out. (If causes stated above are not detected, engine controller may be defective.)		

E-4 Preheater does not operate

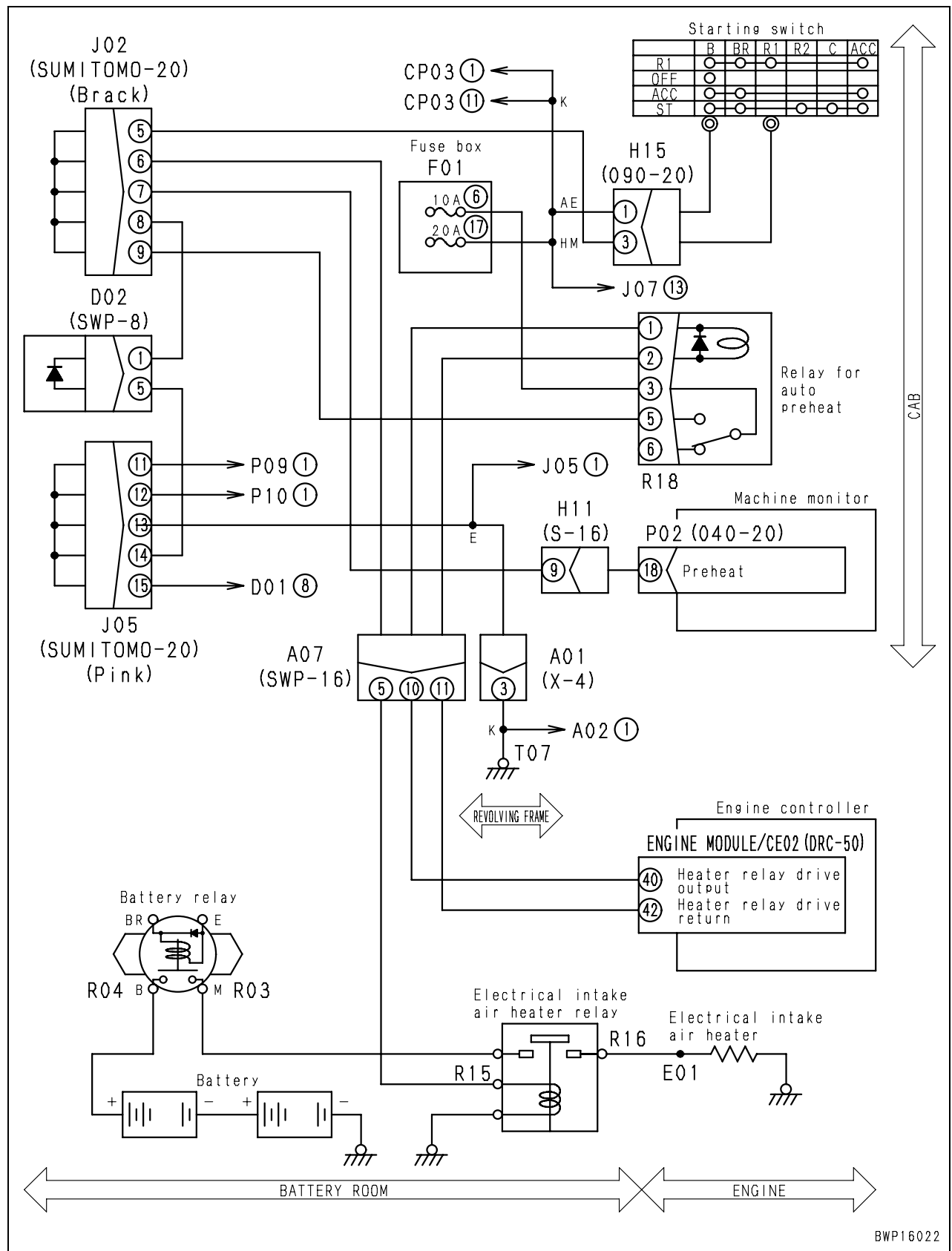
Trouble (1)	When starting switch is turned to HEAT position, preheating monitor does not light up.
Related information	Input of preheating signal (ON/OFF) can be checked with monitoring function. (Code 04500 : Monitor Input 1)

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective starting switch system	If preheating fails to operate (the heater does not warm up), perform troubleshooting for Trouble (2).		
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between P02 (female) (18) – H11 – J02 (male) (7)	Resistance	Max. 1 Ω
	3	Defective machine monitor	★ Prepare with starting switch OFF		
			P02	Starting switch	Voltage
			Between (18) – chassis ground	OFF HEAT	Max. 1 V 20 – 30 V

Trouble (2)	• When starting switch is turned to HEAT position, preheater does not warm up.
Related information	• During low temperature (coolant temperature below -4°C), engine controller actuates to automatically preheat.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective starting switch (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			H15 (male)		Starting switch	Resistance
			Between (1) – (3)	OFF		Min. 1 MΩ
				HEAT		Max. 1 Ω
	2	Defective heater relay (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Heater relay		Resistance	
			Coil terminal (R15) – chassis ground		300 – 600 Ω	
			Between contact terminals		Min. 1 MΩ	
	3	Defective intake air heater (Internal disconnection).	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Between heater terminals		Normal if conductive	
	4	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
Wiring harness between H15 (female) (3) – J02 – A07 – Heater relay terminal R15			Resistance	Max. 1 Ω		
Wiring harness between battery relay terminal M (R03) – Heater relay terminal power supply inlet			Resistance	Max. 1 Ω		

Circuit diagram related

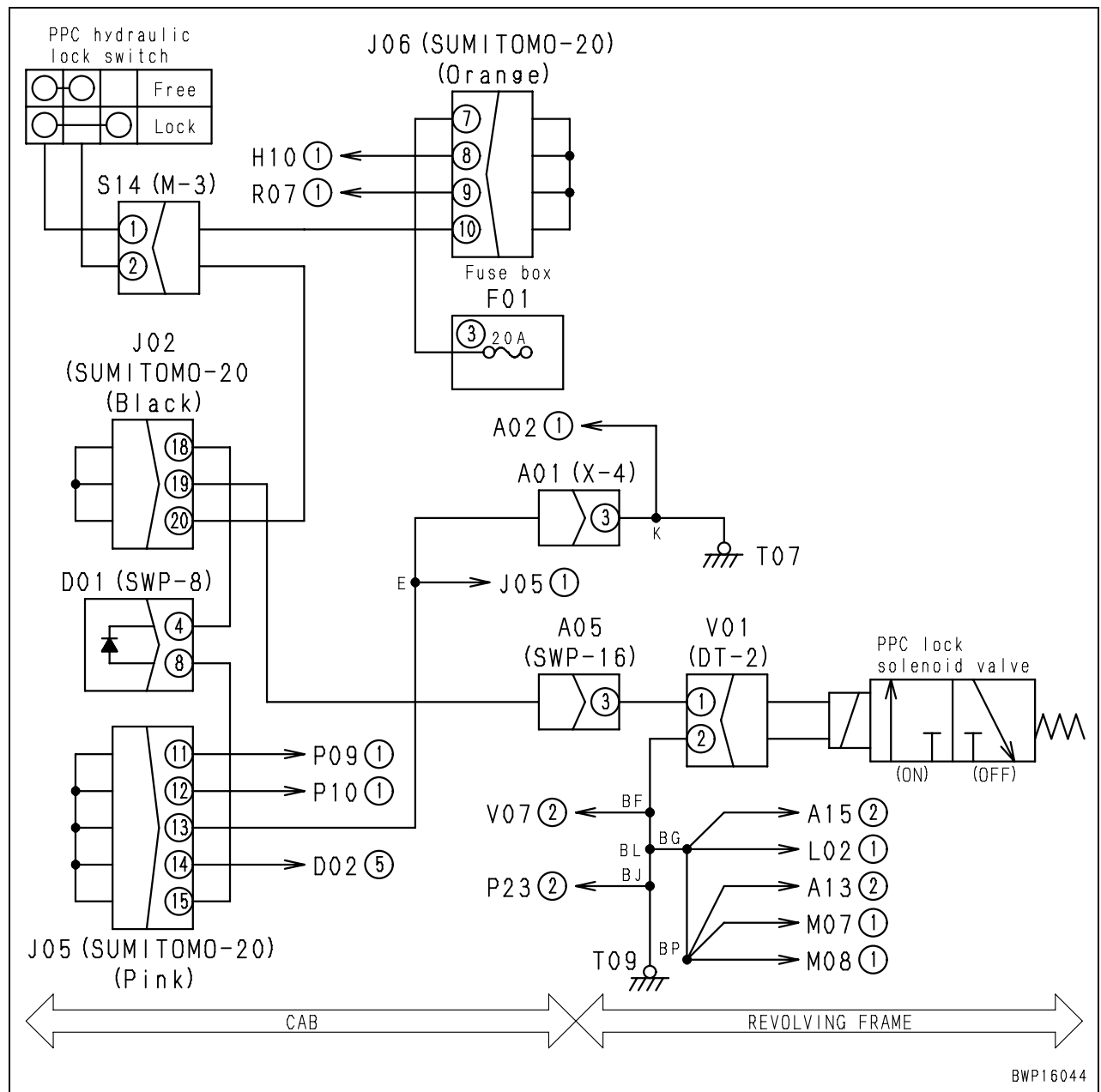


E-5 All work equipment, swing, and travel mechanism do not move

Trouble	• All travel, swing, and work equipment mechanism do not move.
Related information	—

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective fuse No. 3	If fuse is burnt out, the circuit probably has ground fault. (See Cause 4.)			
	2	Defective lock switch (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S14 (female)		Lock lever	Resistance
			Between (1) – (2)	Lock	Min. 1 MΩ	
				Free	Max. 1 Ω	
	3	Defective PPC lock solenoid (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			V01 (male)		Resistance	
			Between (1) – (2)		20 – 60 Ω	
			Between (1) – chassis ground		Min. 1 MΩ	
	4	Defective assembled-type diode D01 (Internal short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			D01 (male)		Resistance	
			Between (4) – (8)		Min. 1 MΩ	
	5	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between F01(3) outlet – J06 – S14 (male) (1)		Resistance	Max. 1 Ω
			Wiring harness between S14 (male) (2) – J02 – A05 – V01 (male) (1)		Resistance	Max. 1 Ω
			Wiring harness between V01 (female) (2) – chassis ground (T09)		Resistance	Max. 1 Ω
	6	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between F01(3) outlet – J06 – S14 (male) (1) and chassis ground (T07)		Resistance	Min. 1 MΩ
			Wiring harness between S14 (male) (2) – J02 – A05 – V01(female) (1), – D01(female) (4) and chassis ground (T07)		Resistance	Min. 1 MΩ

Circuit diagram related

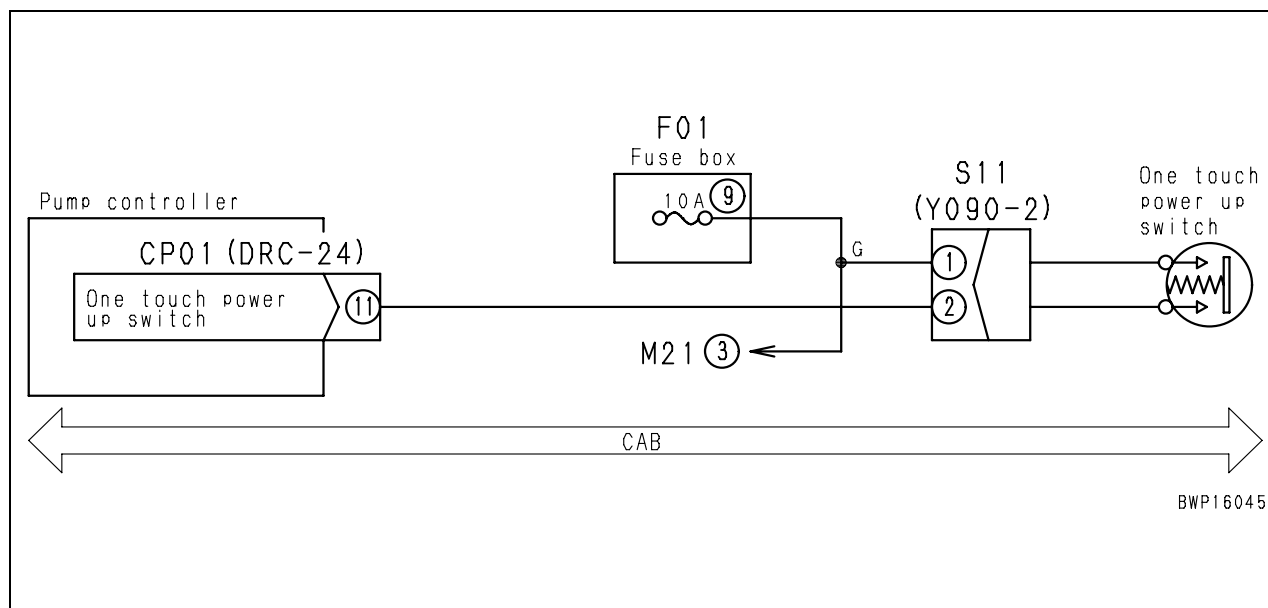


E-6 Power maximizing function does not operate

Trouble	<ul style="list-style-type: none"> Power maximizing function does not work.
Related information	<ul style="list-style-type: none"> Symbol mark is indicated on the machine monitor when the power maximizing switch is depressed during work equipment operation while the engine is running in P- or E-mode. Input state of power maximizing switch (left knob switch) can be checked with monitoring function (Code 02200: Switch Input 1)

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective fuse No. 9	If fuse is burnt out, the circuit probably has ground fault. (See Cause 4.)			
	2	Defective power maximizing switch (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S11 (male)		Switch	Resistance
			Between (1) – (2)	Released		Min. 1 MΩ
				Pressed		Max. 1 Ω
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between F01(9) outlet – S11 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between S11 (female) (2) – CP01 (female) (11)		Resistance	Max. 1 Ω
	4	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between F01(9) outlet – S11 (female) (1) and chassis ground		Resistance	Min. 1 MΩ
			Wiring harness between S11 (female) (2) – CP01 (female) (11) and chassis ground		Resistance	Min. 1 MΩ
	5	Defective pump controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			CP01		Switch	Voltage
			Between (11) – chassis ground	Released		Max. 1 V
				Pressed		20 – 30 V

Circuit diagram related

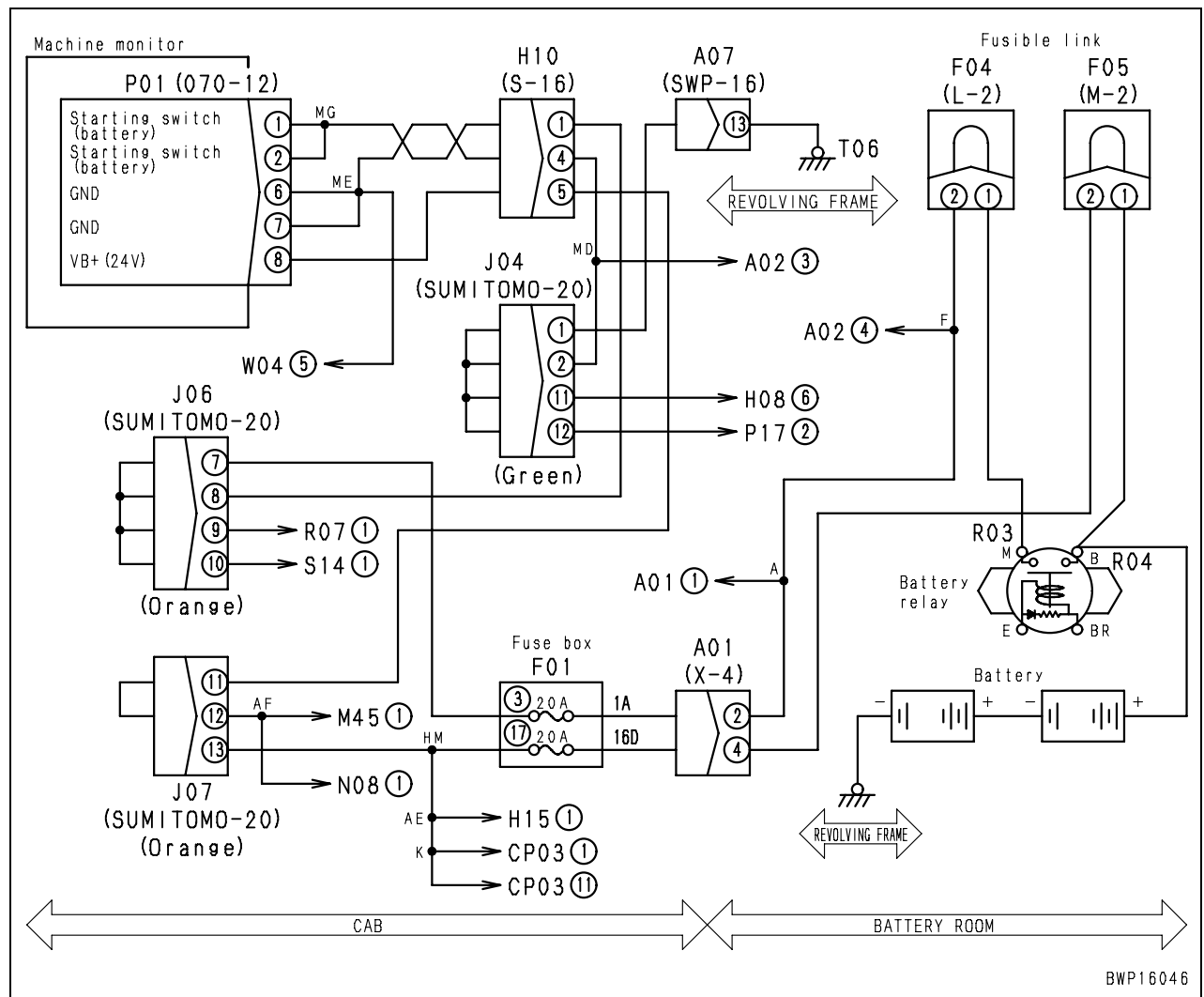


E-7 Machine monitor does not display at all

Trouble	• Machine monitor does not display at all when starting switch is turned ON
Related information	—

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective fuse No. 3	If fuse is burnt out, the circuit probably has ground fault. (See cause 3.)		
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between P01(female) (1), (2) – H10 – J06 – F01(3) outlet	Resistance	Max. 1 Ω
			Wiring harness between P01 (female) (6), (7) – chassis ground (T06)	Resistance	Max. 1 Ω
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between P01(female) (1), (2) – H10 – J06 – F01(3) outlet and chassis ground	Resistance	Min. 1 MΩ
	4	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			P01 (female)	Voltage/Resistance	
			Between (1), (2) – chassis ground (T06)	Voltage: 20 – 30 V	
			Between (6), (7) – chassis ground (T06)	Resistance: Max. 1 Ω	

Circuit diagram related



E-8 Machine monitor does not display some items

Trouble	• Machine monitor does not display some items when starting switch is turned ON
Related information	—

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective machine monitor LCD	When following switches are operated, if all LCD panel is lighted up (all surface becomes white), LCD panel is normal. • Switch operation: [↶] + [A] (Simultaneous operation)
	2	Defective machine monitor	Since trouble is in system, troubleshooting cannot be carried out. (If causes stated above are not detected, engine controller may be defective.)

E-9 Contents of display by machine monitor are different from applicable machine

Trouble	• Contents of display by machine monitor are different from applicable machine.
Related information	—

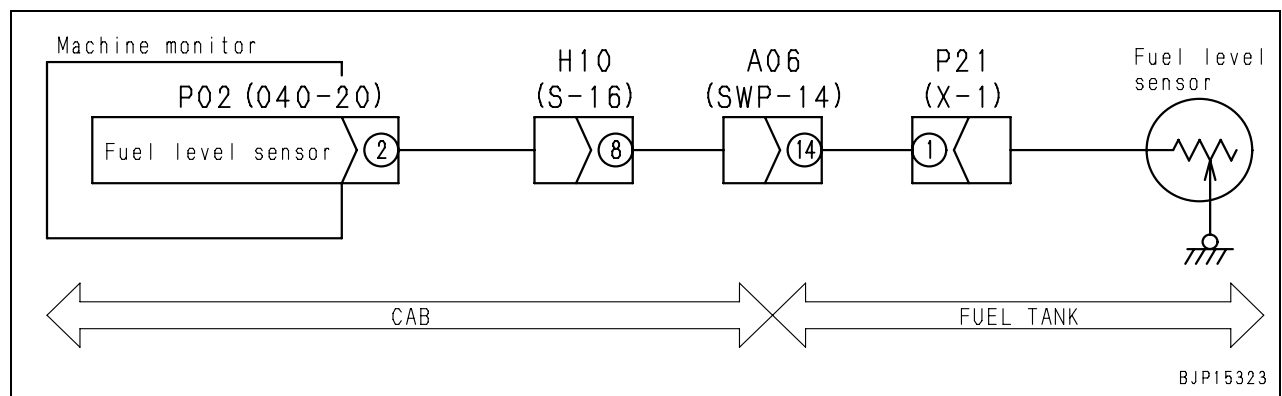
Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective model code signal (Internal defect)	In the case monitoring display is not normal, proceed to failure code [DA2SKQ].		
			Monitoring code	Item	Normal display
			00200	Controller model code	228
			00201	Select model	
	2	Defective machine monitor	Since trouble is in system, troubleshooting cannot be carried out. (If causes stated above are not detected, engine controller may be defective.)		

E-10 Fuel level monitor was lighted in red while engine running

Trouble	<ul style="list-style-type: none"> Fuel level monitor was lighted in red while the engine running
Related information	<ul style="list-style-type: none"> If fuel level gauge on the machine monitor indicates red range, fuel level monitor turns red. Input signal (voltage) from the fuel level sensor can be checked with monitoring function. (Code 04200: Fuel level sensor voltage)

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Low fuel level (When system is normal)	★ Add fuel			
	2	Defective fuel level sensor (Internal disconnection)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			P21 (male)	Fuel level	Resistance	
			Between (1) and chassis ground	FULL (Upper limit)	Approx. 12 Ω	
				EMPTY (Lower limit)	85 – 110 Ω	
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between P02 (female) (2) – H10 – A06 – P21 (female) (1)		Resistance	Max. 1 Ω
	4	Defective machine monitor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			P02 (female)	Fuel level	Resistance	
			Between (2) and chassis ground	FULL (Upper limit)	Approx. 12 Ω	
				EMPTY (Lower limit)	85 – 110 Ω	

Circuit diagram related

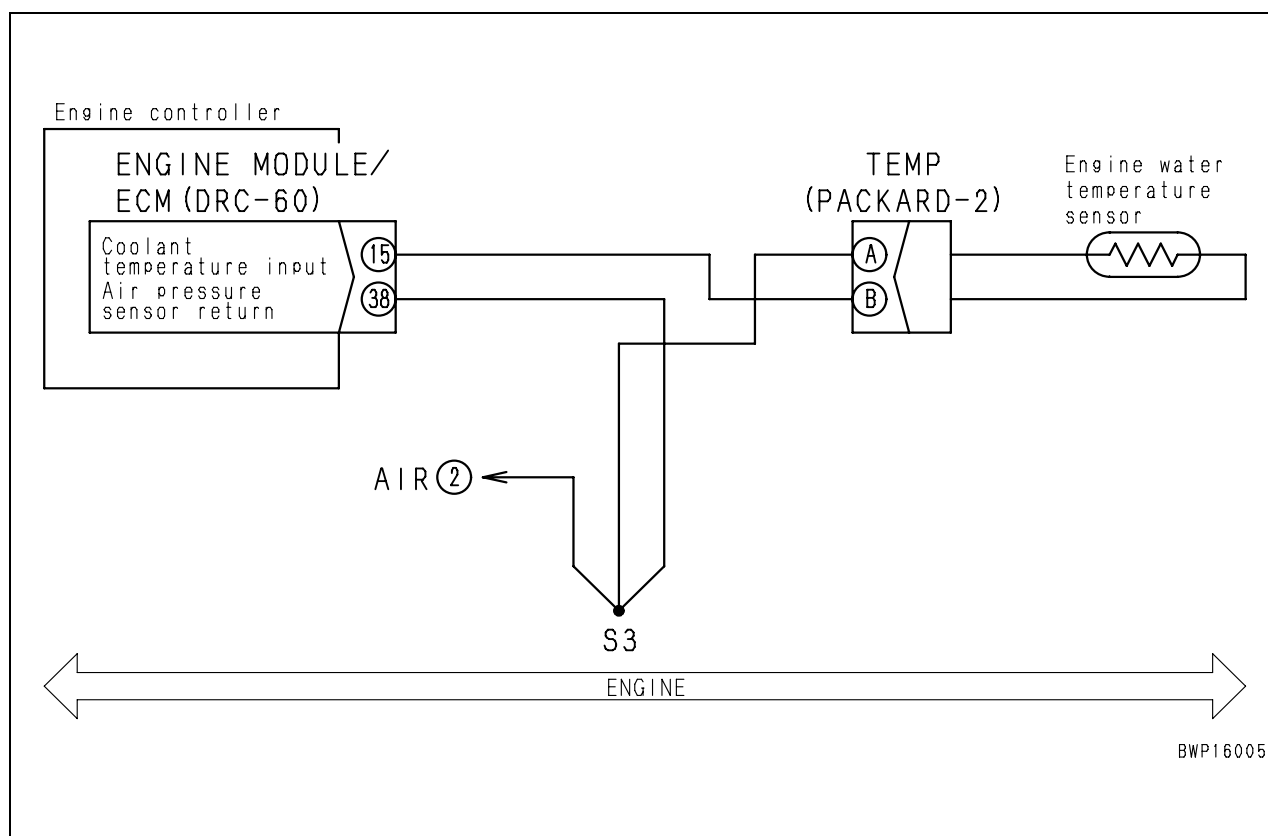


E-11 Engine coolant temperature gauge does not indicate normally

Trouble	<ul style="list-style-type: none"> While engine coolant temperature is rising normally, temperature gauge does not rise from white range (C). While engine coolant temperature is stabilized normally, temperature gauge rises to red range (H).
Related information	<ul style="list-style-type: none"> Input from the engine coolant temperature sensor (temperature) can be checked with monitoring function. (Code 04105: Engine coolant temperature sensor voltage) Check if failure code for abnormal communication (machine monitor) system [DAFRMC] is indicated (if yes, diagnose that failure first.) Signal of engine coolant temperature sensor is input to engine controller and then its information is transmitted to machine monitor through communication system.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective coolant temperature sensor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			TEMP (male)		Resistance
			Between (A) – (B)		0.18 – 160 kΩ
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE01 (female) (15) – TEMP (female) (B)	Resistance	Max. 10 Ω
			Wiring harness between CE01 (female) (38) – S3 – TEMP (female) (A)	Resistance	Max. 10 Ω
	3	Short circuit in wiring harness (with another wiring harness)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CE01 (female) (15) – each of CE01 (female) pins (With all wiring harness connectors disconnected)	Resistance	Min. 100 kΩ
	4	Defective wiring harness connector	Connecting parts between coolant temperature sensor – engine wiring harness – engine controller may be defective. Check them directly. <ul style="list-style-type: none"> Looseness of connector, breakage of lock, or breakage of seal Corrosion, bend, breakage, push-in, or expansion of pin Moisture or dirt in connector or defective insulation 		
	5	Defective engine controller	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			CE01 (female)		Resistance
			Between (15) – (38)		0.18 – 160 kΩ

Circuit diagram related

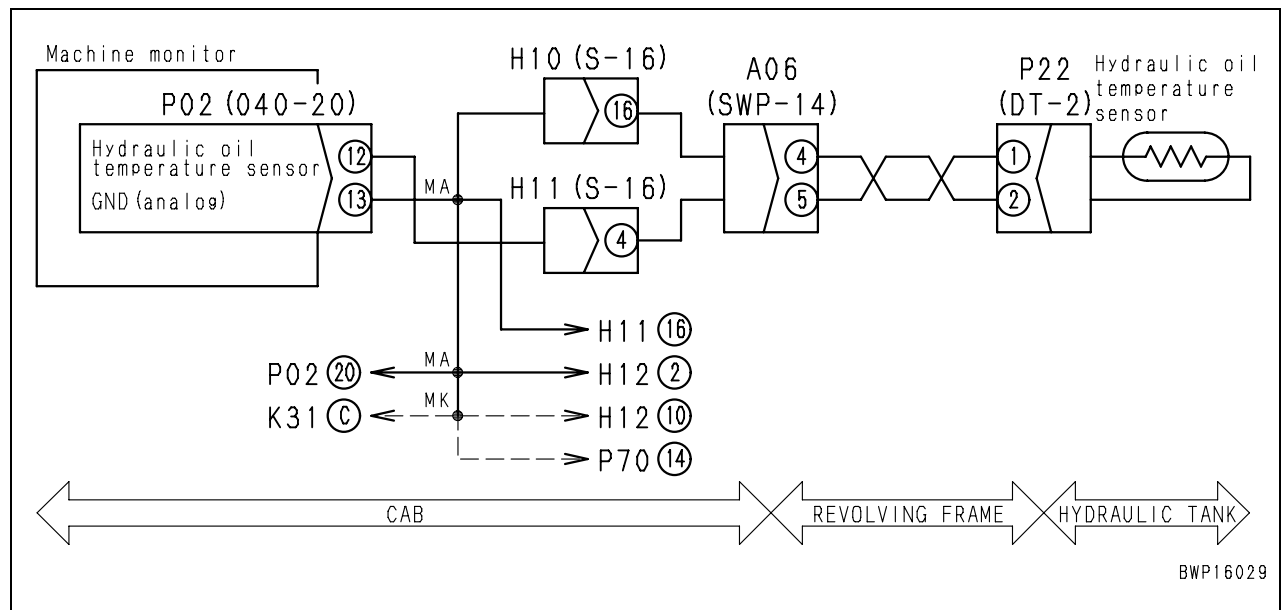


E-12 Hydraulic oil temperature gauge does not indicate normally

Trouble	<ul style="list-style-type: none"> While hydraulic oil temperature is rising normally, temperature gauge does not rise from white range (C). While hydraulic oil temperature is stabilized normally, temperature gauge rises to red range (H).
Related information	<ul style="list-style-type: none"> Input from the hydraulic oil temperature sensor (temperature) can be checked with monitoring function. (Code 04402: Hydraulic oil temperature sensor voltage)

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective hydraulic oil temperature sensor (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			P22 (male)	Hydraulic oil temperature	Resistance	
			Between (2) – (1)	10 – 100°C	90 – 3.5 kΩ	
			Between (2) – chassis ground		Min. 1 MΩ	
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between P02 (female) (12) – P22 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between P02 (female) (13) – P22 (female) (1)		Resistance	Max. 1 Ω
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between P02 (female) (12) – P22 (female) (2) and chassis ground		Resistance	Min. 1 MΩ
	4	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between P02 (female) (12) – P22 (female) (2) and chassis ground		Voltage	Max. 1 V
	5	Defective machine monitor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			P02	Hydraulic oil temperature	Resistance	
			Between (12) – (13)	10 – 100°C	90 – 3.5 kΩ	
			Between (12) – chassis ground		Min. 1 MΩ	

Circuit diagram related

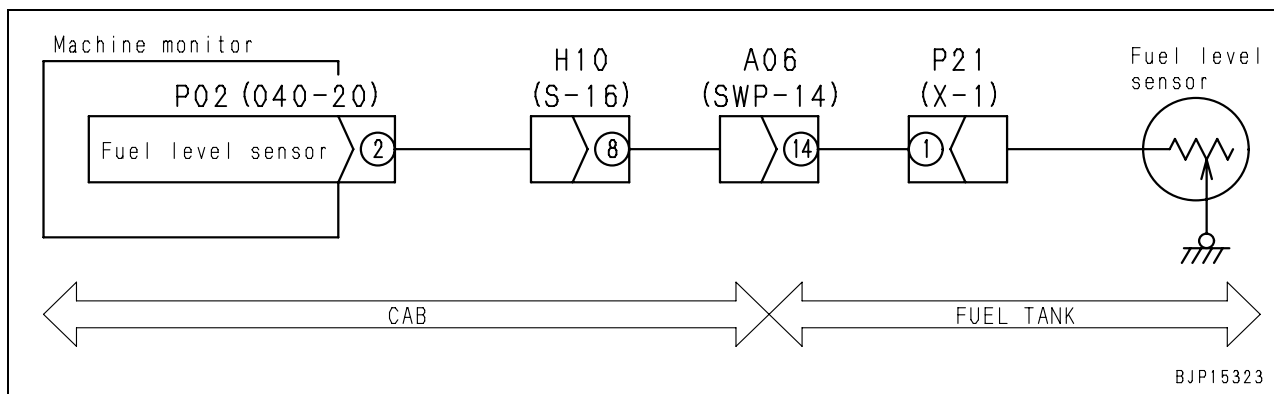


E-13 Fuel level gauge does not indicate normally

Trouble	<ul style="list-style-type: none"> While fuel is added, fuel level gauge does not rise from red range (E). While fuel level is low, fuel level gauge does not lower from green range (F)
Related information	<ul style="list-style-type: none"> Input signal (voltage) from the fuel level sensor can be checked with monitoring function. (Code 04200: Fuel level sensor voltage)

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective fuel level sensor (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			P21 (male)	Fuel level	Resistance	
			Between (1) – chassis ground	FULL (Upper limit)	Approx. 12 Ω	
		EMPTY (Lower limit)		85 – 110 Ω		
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between P02 (female) (2) – H10 – A06 – P21 (female) (1)		Resistance	Max. 1 Ω
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between P02 (female) (2) – H10 – A06 – P21 (female) (1) and chassis ground		Resistance	Min. 1 MΩ
	4	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between P02 (female) (2) – H10 – A06 – P21 (female) (1) and chassis ground		Voltage	Max. 1 V
	5	Defective machine monitor	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			P02	Fuel level	Resistance	
			Between (2) – chassis ground	FULL (Upper limit)	Approx. 12 Ω	
	EMPTY (Lower limit)	85 – 110 Ω				

Circuit diagram related

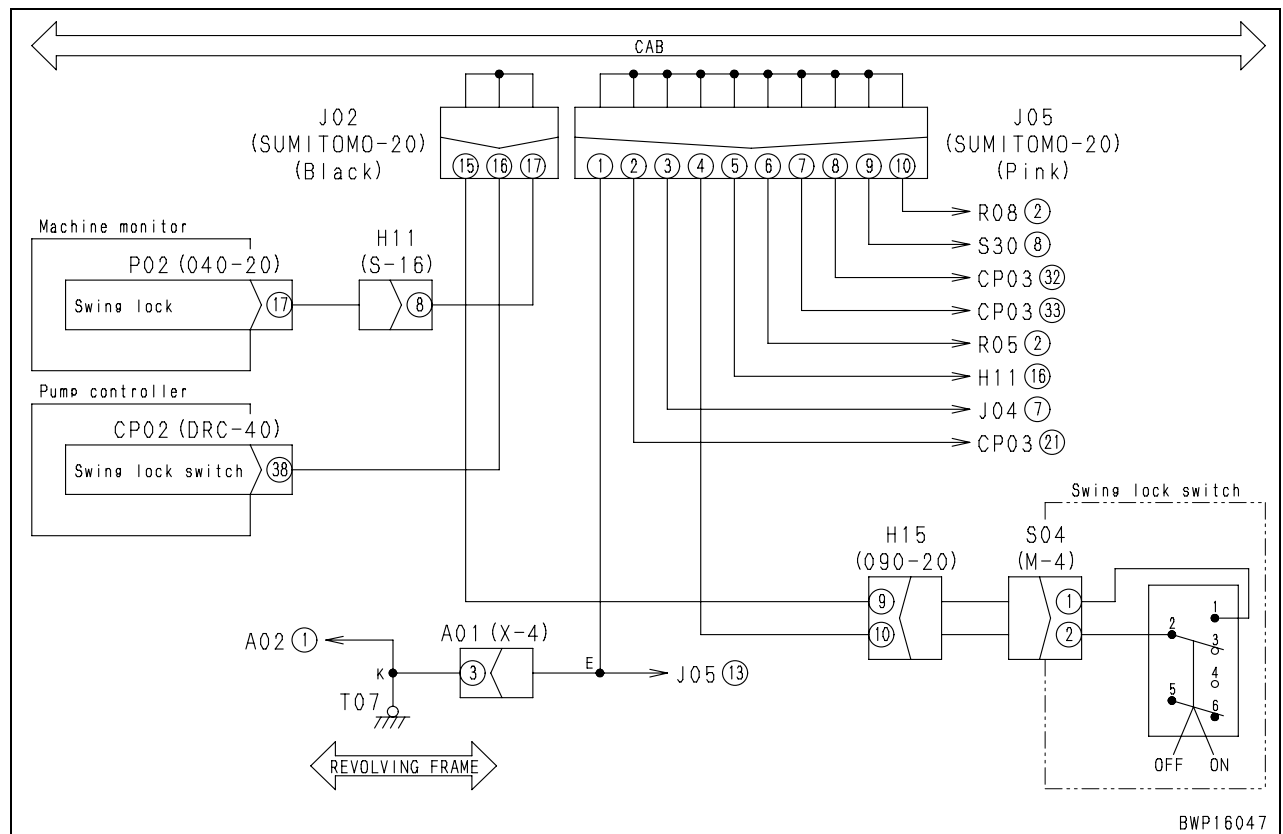


E-14 Swing lock monitor does not indicate normally

Trouble	<ul style="list-style-type: none"> When swing lock switch is turned ON, swing lock monitor does not light up. When swing lock switch is turned OFF, swing lock monitor lights up.
Related information	<ul style="list-style-type: none"> Input from swing lock switch (ON/OFF) can be checked with monitoring function. (Code 04502: Monitor Input 3)

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective swing lock switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			S04 (female)		Swing lock switch	Resistance
			Between (1) – (2)	OFF	Min. 1 MΩ	
				ON	Max. 1 Ω	
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between P02 (female) (17) – H11 – J02 – H15 – S04 (male) (1)		Resistance	Max. 1 Ω
			Wiring harness between S04 (male) (2) – J05 – A01 – chassis ground (T07)		Resistance	Max. 1 Ω
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between P02 (female) (17) – H11 – J02 – H15 – S04 (male) (1) and chassis ground		Resistance	Min. 1 MΩ
	4	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between P02 (female) (17) – H11 – J02 – H15 – S04 (male) (1) and chassis ground		Voltage	Max. 1 V
	5	Defective machine monitor	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			P02		Swing lock switch	Voltage
Between (17) – chassis ground (T07)			OFF	20 – 30 V		
			ON	Max. 1 V		

Circuit diagram related



E-15 When monitor switch is operated, monitor displays nothing

Trouble (1)	• Operating the working mode select switch fails to display working mode monitor.
Related information	—

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective machine monitor	

Since trouble is in system, troubleshooting cannot be carried out.

Trouble (2)	• When auto-decelerator switch is operated, auto-decelerator monitor is not displayed.
Related information	★ If auto-decelerator fails to operate, proceed with troubleshooting No. E-2.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective machine monitor	

Since trouble is in system, troubleshooting cannot be carried out.

Trouble (3)	• Operating the travel speed select switch fails to display travel speed monitor.
Related information	★ If travel speed selection fails, proceed with troubleshooting No. H-21.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective machine monitor	

Since trouble is in system, troubleshooting cannot be carried out.

Trouble (4)	• When wiper switch is operated, wiper monitor is not displayed.
Related information	★ If wiper fails to operate, proceed with troubleshooting No. E-16.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective machine monitor	

Since trouble is in system, troubleshooting cannot be carried out.

Trouble (5)	<ul style="list-style-type: none"> • When select switch is operated, adjust screen is not displayed. • When LCD monitor adjust switch is operated, adjust screen is not displayed. • When maintenance switch is operated, maintenance item screen is not displayed.
Related information	—

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Defective machine monitor	

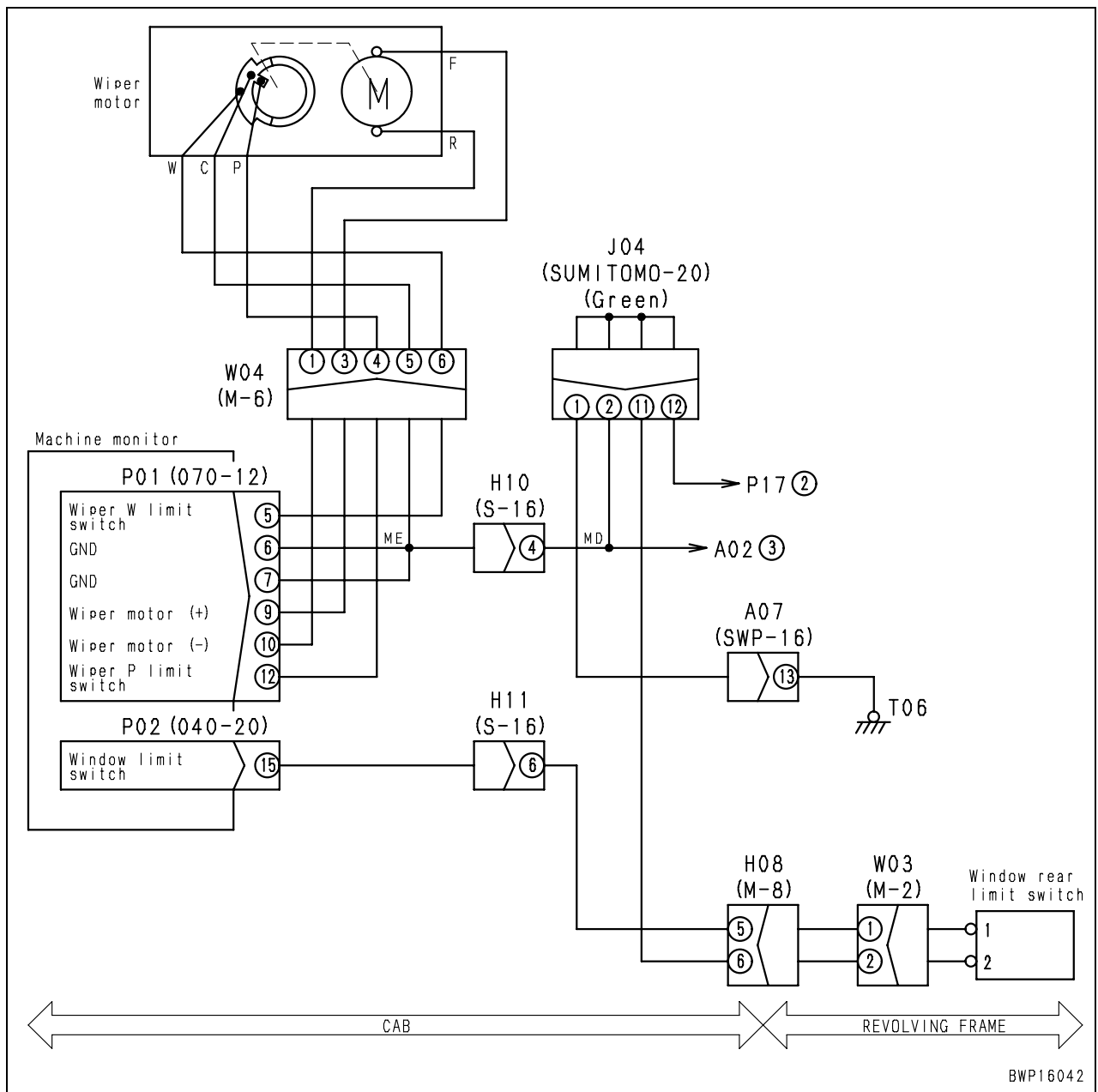
Since trouble is in system, troubleshooting cannot be carried out.

E-16 Windshield wiper and window washer do not operate

Trouble	<ul style="list-style-type: none"> Windshield wiper and window washer do not operate 	(1) Windshield wiper does not operate.
Related information	<ul style="list-style-type: none"> Input from window limit switch (ON/OFF) can be checked with monitoring function. (Code 04502: Monitor Input 3) 	

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective window limit switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			W03 (male)	Front window	Resistance	
			Between (1) – (2)	When installed to front	Min. 1 MΩ	
				When retracted to rear	Max. 1 Ω	
	2	Defective wiper motor (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			W04 (male)		Resistance	
			Between (3) – (1)		There is continuity	
			Between (3), (1) – chassis ground		Min. 1 MΩ	
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between P01 (female) (9) – W04 (female) (3)		Resistance	Max. 1 Ω
			Wiring harness between P01 (female) (10) – W04 (female) (1)		Resistance	Max. 1 Ω
	4	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between P02 (female) (15) – H11 – H08 – W03 (female) (1) and chassis ground		Resistance	Min. 1 MΩ
	5	Defective machine monitor (window limiter switch system)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			P02	Front window	Voltage	
			Between (15) – chassis ground	When installed to front	20 – 30 V	
				When retracted to rear	Max. 1 V	
		Defective machine monitor (Wiper motor system)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			P01	Wiper switch	Voltage	
			Between (9) – chassis ground Between (10) – chassis ground	OFF	Max. 3 V	
				ON	Max. 3 V ⇔ 20 – 30 V (Constant cycle)	

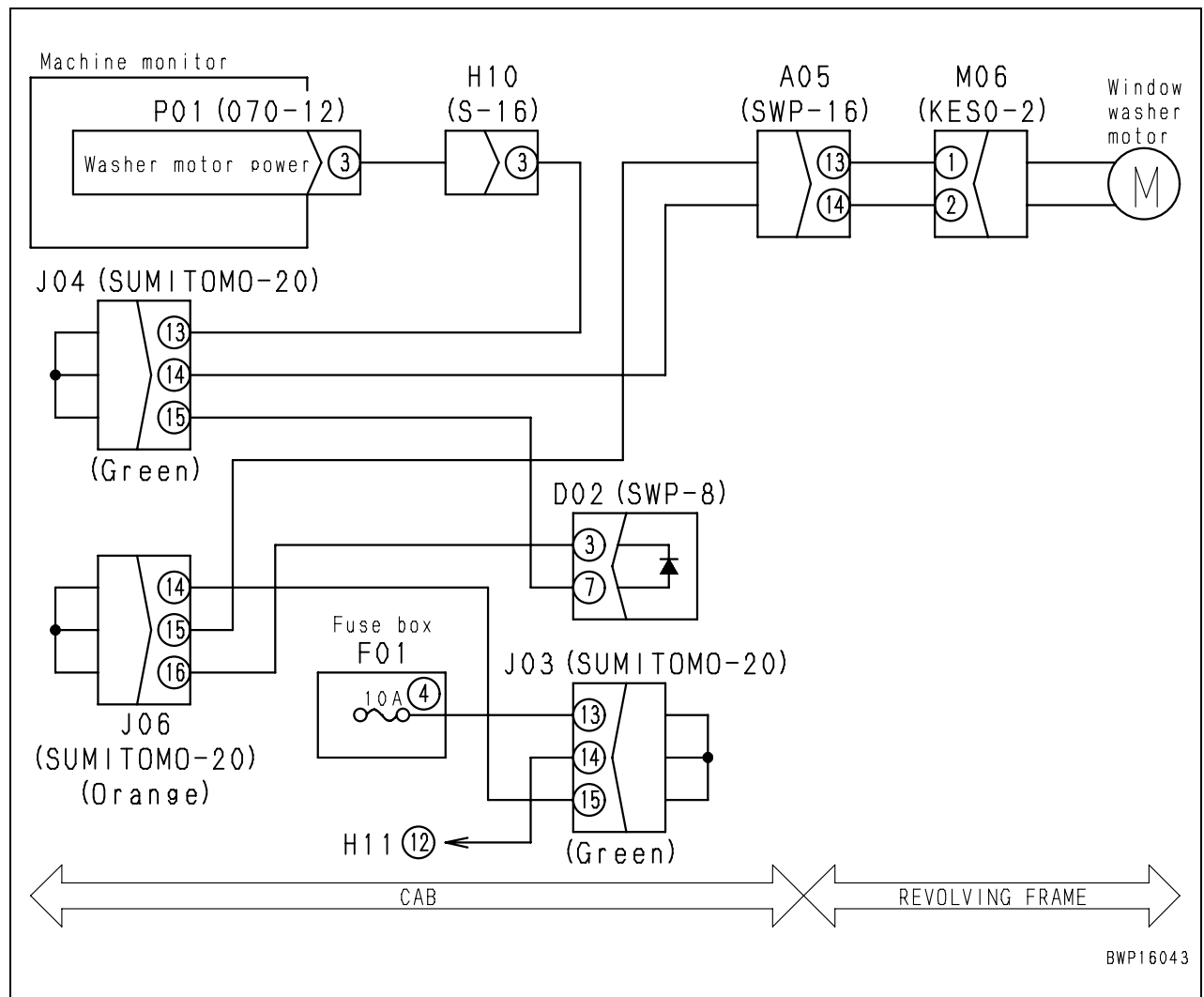
Circuit diagram related



Trouble	• Windshield wiper and window washer do not operate	(2) Window washer does not operate.
Related information		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective fuse No. 4	If fuse is broken, circuit probably has ground fault (See cause 4).			
	2	Defective washer motor (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			M06 (male)		Resistance	
			Between (1) – (2)		5 – 20 Ω	
			Between (1) – chassis ground		Min. 1 MΩ	
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between F01(4) – J03 – J06 – A05 – M06 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between M06 (female) (2) – A05 – J04 – H10 – P01 (female) (3)		Resistance	Max. 1 Ω
	4	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between F01(4) – J03 – J06 – A05 – M06 (female) (1), – D02 (female) (3), – other harnesses between related circuits and chassis ground		Resistance	Min. 1 MΩ
			Wiring harness between M06 (female) (2) – A05 – J04 – H10 – P01 (female) (3), – D02 (female) (7) and chassis ground		Resistance	Min. 1 MΩ
	5	Defective machine monitor (Window limiter switch system)	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			P01	Windshield washer switch	Voltage	
			Between (3) – chassis ground	OFF	20 – 30 V	
	ON	Max. 1 V				

Circuit diagram related

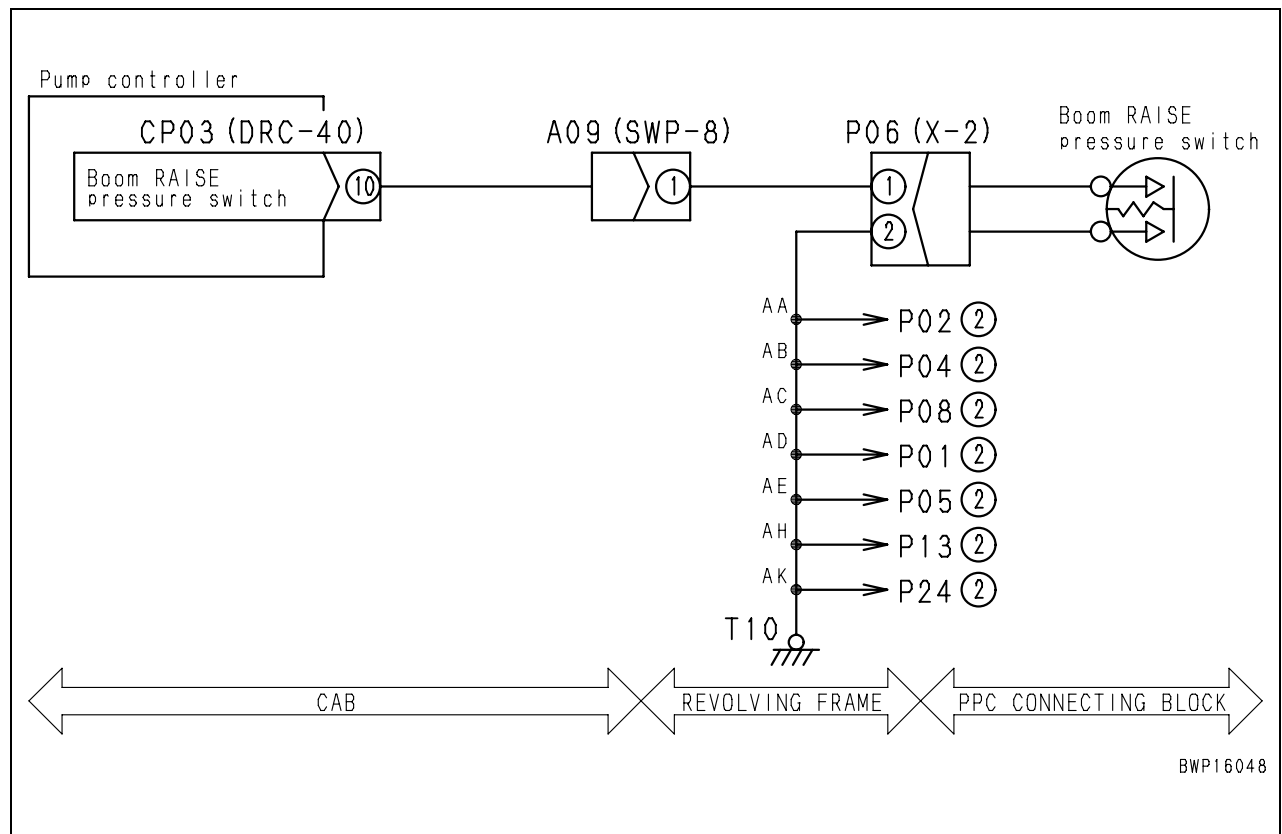


E-17 Monitoring function fails to display “boom raise” normally

Trouble	<ul style="list-style-type: none"> Boom RAISE operation is not displayed normally by machine monitoring function (Special functions)
Related information	<ul style="list-style-type: none"> Monitoring code: 01900 (Pressure Switch 1)

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective boom RAISE PPC oil pressure switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			P06 (male)		Boom lever	Resistance
			Between (1) – (2)	Neutral	Min. 1 MΩ	
				Boom RAISE	Max. 1 Ω	
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CP03 (female) (10) – P06 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between P06 (female) (2) – chassis ground (T10)		Resistance	Max. 1 Ω
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CP03 (female) (10) – P06 (female) (1) and chassis ground (T10)		Resistance	Min. 1 MΩ
	4	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between CP03 (female) (10) – P06 (female) (1) and chassis ground (T10)		Voltage	Max. 1 V
	5	Defective pump controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			CP03	Boom lever	Voltage	
			Between (10) – chassis ground (T10)	Neutral	20 – 30 V	
				Boom RAISE	Max. 1 V	

Circuit diagram related

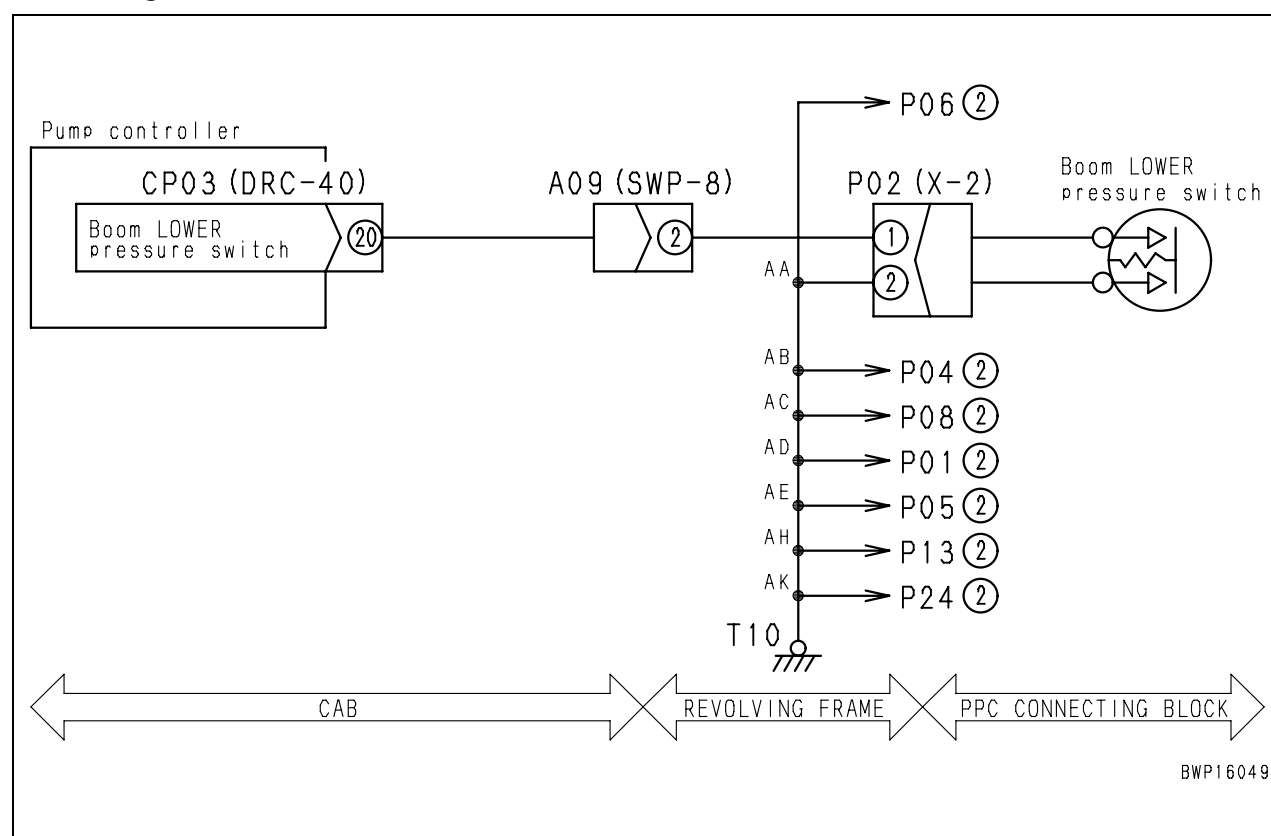


E-18 Monitoring function fails to display “boom lower” normally

Trouble	<ul style="list-style-type: none"> Boom LOWER operation is not displayed normally by machine monitoring function (Special functions)
Related information	<ul style="list-style-type: none"> Monitoring code: 01900 (Pressure Switch 1)

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective boom LOWER PPC oil pressure switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			P02 (male)		Boom lever	Resistance
			Between (1) – (2)	Neutral	Min. 1 MΩ	
				Boom LOWER	Max. 1 Ω	
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CP03 (female) (20) A09 – P02 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between P02 (female) (2) – chassis ground (T10)		Resistance	Max. 1 Ω
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CP03 (female) (20) A09 – P02 (female) (1) and chassis ground (T10)		Resistance	Min. 1 MΩ
	4	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between CP03 (female) (20) A09 – P02 (female) (1) and chassis ground (T10)		Voltage	Max. 1 V
	5	Defective pump controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			CP03	Boom lever	Voltage	
			Between (20) – chassis ground (T10)	Neutral	20 – 30 V	
				Boom LOWER	Max. 1 V	

Circuit diagram related

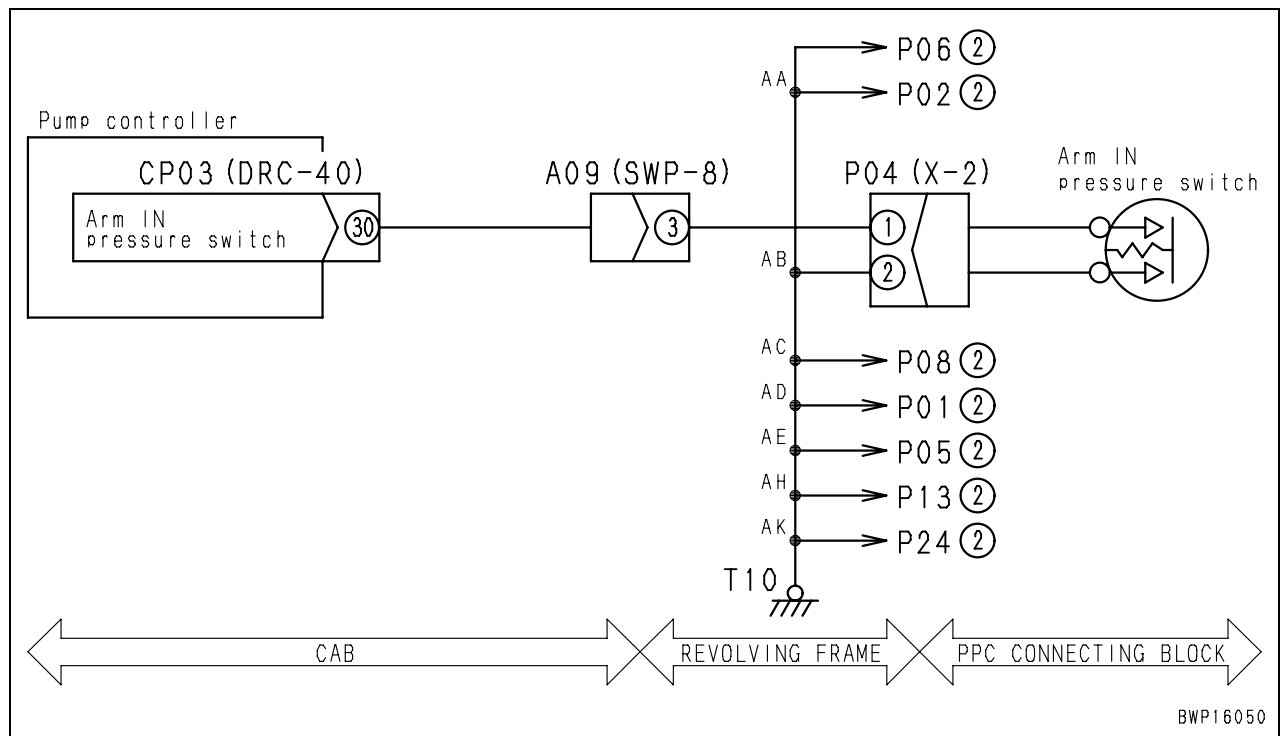


E-19 Monitoring function fails to display “arm IN” normally

Trouble	• Arm IN operation is not displayed normally by machine monitoring function (Special functions)
Related information	• Monitoring code: 01900 (Pressure Switch 1)

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting				
	1	Defective arm IN pressure sensor (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.				
			P04 (male)		Arm lever	Resistance	
			Between (1) – (2)	Neutral		Min. 1 MΩ	
				IN		Max. 1 Ω	
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.				
			Wiring harness between CP03 (female) (30) – A09 – P04 (female) (1)		Resistance	Max. 1 Ω	
			Wiring harness between P04 (female) (2) – chassis ground (T10)		Resistance	Max. 1 Ω	
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.				
			Wiring harness between CP03 (female) (30) – A09 – P04 (female) (1) and chassis ground (T10)		Resistance	Min. 1 MΩ	
	4	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.				
			Wiring harness between CP03 (female) (30) – A09 – P04 (female) (1) and chassis ground (T10)		Voltage	Max. 1 V	
	5	Defective pump controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.				
			CP03		Arm lever	Voltage	
			Between (30) – chassis ground (T10)	Neutral		20 – 30 V	
				IN		Max. 1 V	

Circuit diagram related

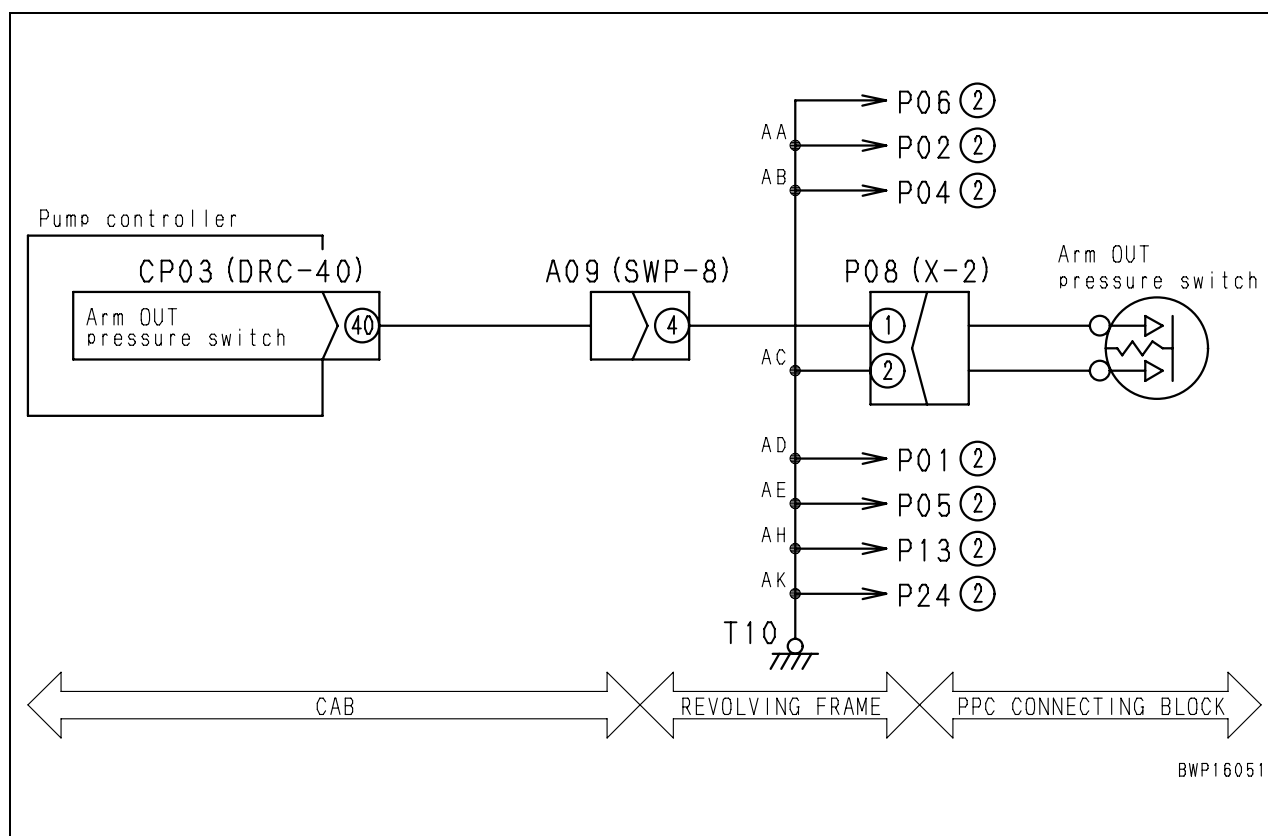


E-20 Monitoring function fails to display “arm OUT” normally

Trouble	• Arm OUT operation is not displayed normally by machine monitoring function (Special functions)
Related information	• Monitoring code: 01900 (Pressure Switch 1)

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting				
	1	Defective arm OUT PPC oil pressure switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.				
			P08 (male)		Arm lever	Resistance	
			Between (1) – (2)	Neutral		Min. 1 MΩ	
				Arm OUT		Max. 1 Ω	
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.				
			Wiring harness between CP03 (female) (40) – A09 – P08 (female) (1)		Resistance	Max. 1 Ω	
			Wiring harness between P08 (female) (2) – chassis ground (T10)		Resistance	Max. 1 Ω	
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.				
			Wiring harness between CP03 (female) (40) – A09 – P08 (female) (1) and chassis ground (T10)		Resistance	Min. 1 MΩ	
	4	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.				
			Wiring harness between CP03 (female) (40) – A09 – P08 (female) (1) and chassis ground (T10)		Voltage	Max. 1 V	
	5	Defective pump controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.				
			CP03		Arm lever	Voltage	
			Between (40) – chassis ground (T10)	Neutral		20 – 30 V	
				Arm OUT		Max. 1 V	

Circuit diagram related

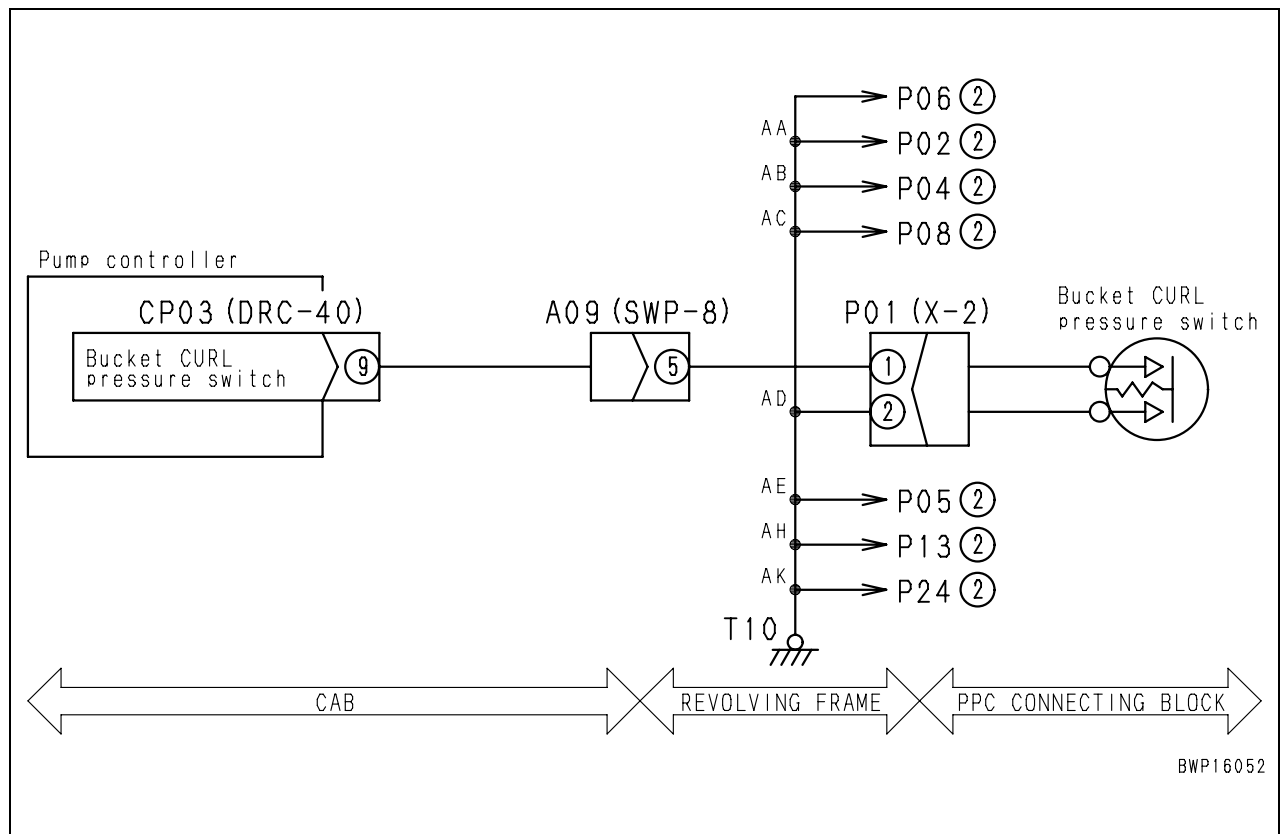


E-21 Monitoring function fails to display “bucket CURL” normally

Trouble	• Bucket CURL is not displayed normally by machine monitoring function (Special functions)
Related information	• Monitoring code:01901 (Pressure Switch 2)

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective bucket CURL pressure sensor (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			P01 (male)		Bucket lever	Resistance
			Between (1) – (2)	Neutral	Min. 1 MΩ	
				CURL	Max. 1 Ω	
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CP03 (female) (9) – A09 – P01 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between P01 (female) (2) – chassis ground (T10)		Resistance	Max. 1 Ω
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CP03 (female) (9) – A09 – P01 (female) (1) and chassis ground (T10)		Resistance	Min. 1 MΩ
	4	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between CP03 (female) (9) – A09 – P01 (female) (1) and chassis ground (T10)		Voltage	Max. 1 V
	5	Defective pump controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			CP03	Bucket lever	Voltage	
			Between (9) – chassis ground (T10)	Neutral	20 – 30 V	
				CURL	Max. 1 V	

Circuit diagram related

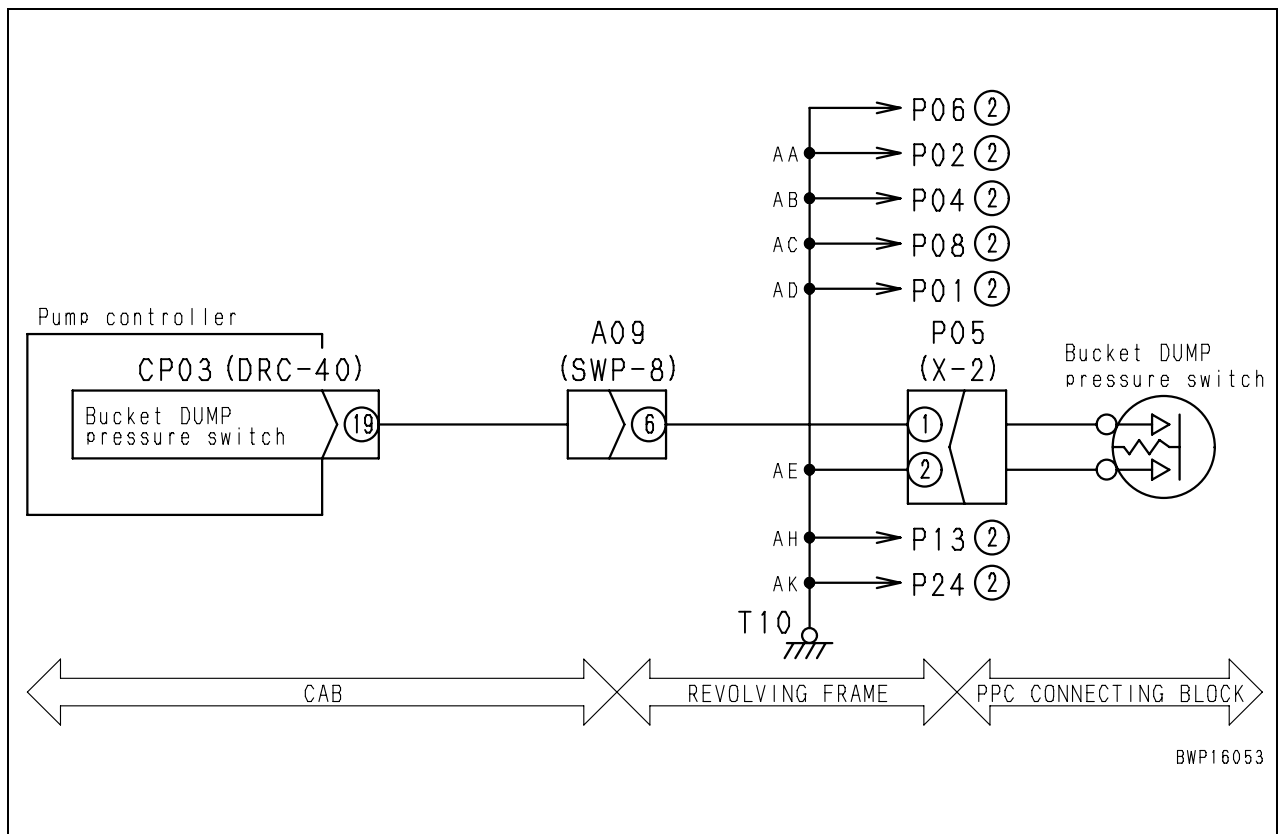


E-22 Monitoring function fails to display “bucket DUMP” normally

Trouble	<ul style="list-style-type: none"> Bucket DUMP operation is not displayed normally by machine monitoring function (Special functions)
Related information	<ul style="list-style-type: none"> Monitoring code: 01901 (Pressure Switch 2)

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting				
	1	Defective bucket DUMP PPC oil pressure switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.				
			P05 (male)		Bucket lever	Resistance	
			Between (1) – (2)	Neutral		Min. 1 MΩ	
				Bucket DUMP		Max. 1 Ω	
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.				
			Wiring harness between CP03 (female) (19) – A09 – P05 (female) (1)		Resistance	Max. 1 Ω	
			Wiring harness between P05 (female) (2) – chassis ground (T10)		Resistance	Max. 1 Ω	
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.				
			Wiring harness between CP03 (female) (19) – A09 – P05 (female) (1) and chassis ground (T10)		Resistance	Min. 1 MΩ	
	4	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.				
			Wiring harness between CP03 (female) (19) – A09 – P05 (female) (1) and chassis ground (T10)		Voltage	Max. 1 V	
	5	Defective pump controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.				
			CP03		Bucket lever	Voltage	
			Between (19) – chassis ground (T10)	Neutral		20 – 30 V	
				Bucket DUMP		Max. 1 V	

Circuit diagram related

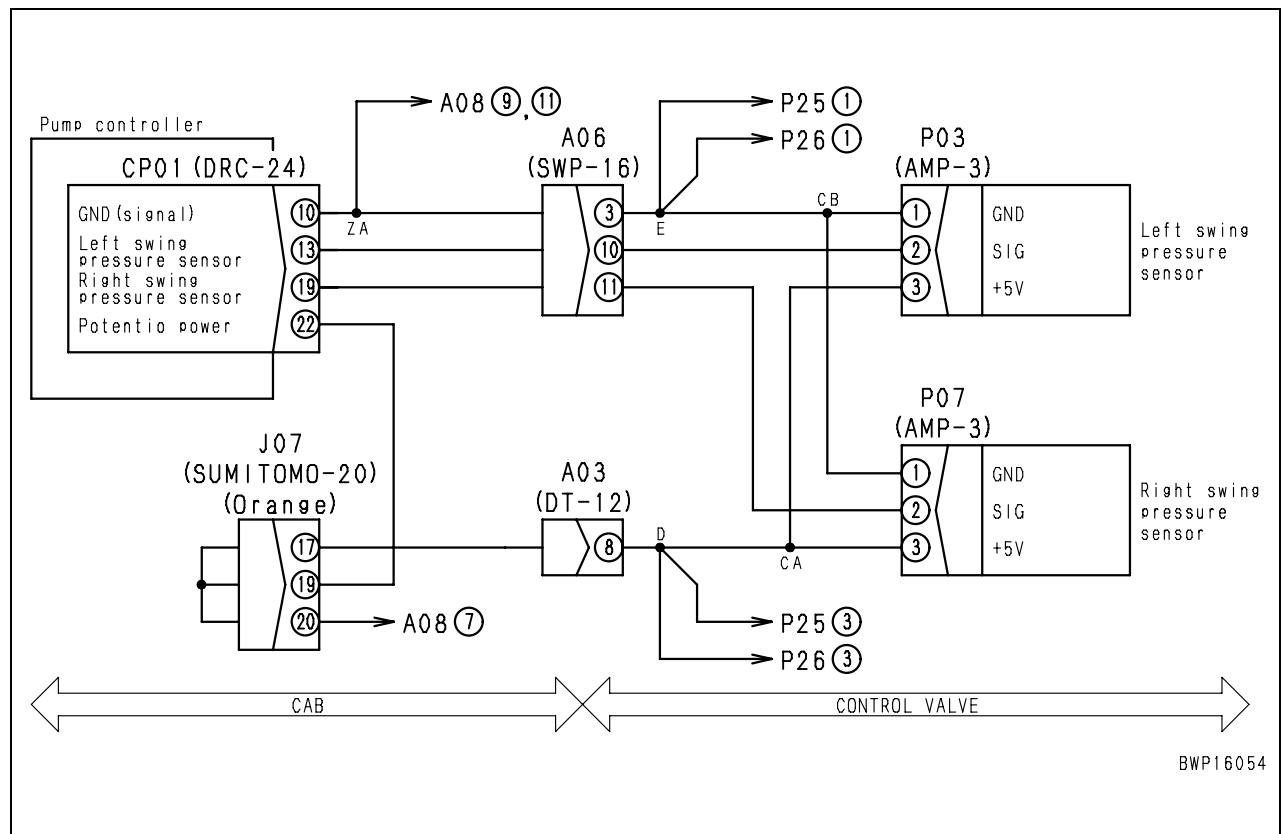


E-23 Monitoring function fails to display “swing left” normally

Trouble	<ul style="list-style-type: none"> Swing left is not displayed normally by machine monitoring function (Special function)
Related information	<ul style="list-style-type: none"> If failure code DHSBMA is displayed, carry out troubleshooting for it first. Monitoring code: 09001 (Swing left PPC pressure)

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective swing left PPC oil pressure switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.		
			P03		Voltage
			Between (3) – (1)		4.5 – 5.5 V
			Between (2) – (1)		0.5 – 4.5 V
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CP01 (female) (13) – A06 – P03 (male) (2)		Resistance Max. 1 Ω
			Wiring harness between CP01 (female) (22) – A03 – P03 (female) (3)		Resistance Max. 1 Ω
			Wiring harness between CP01 (female) (10) – A06 – P03 (female) (1)		Resistance Max. 1 Ω
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between CP01 (female) (13) – A06 – P03 (female) (2)		Resistance Min. 1 MΩ
			Wiring harness between CP01 (female) (22) – A03 – P03 (female) (3) and chassis ground		Resistance Min. 1 MΩ
	4	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Wiring harness between CP01 (female) (13) – A06 – P03 (female) (2)		Voltage Max. 1 V
			Wiring harness between CP01 (female) (22) – A03 – P03 (female) (3) and chassis ground		Voltage Max. 1 V
	5	Defective pump controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			CP01	Swing lever	Voltage
			Between (22) – (10)	Neutral	4.5 – 5.5 V
			Between (13) – (10)	Operate left	0.5 – 4.5 V

Circuit diagram related

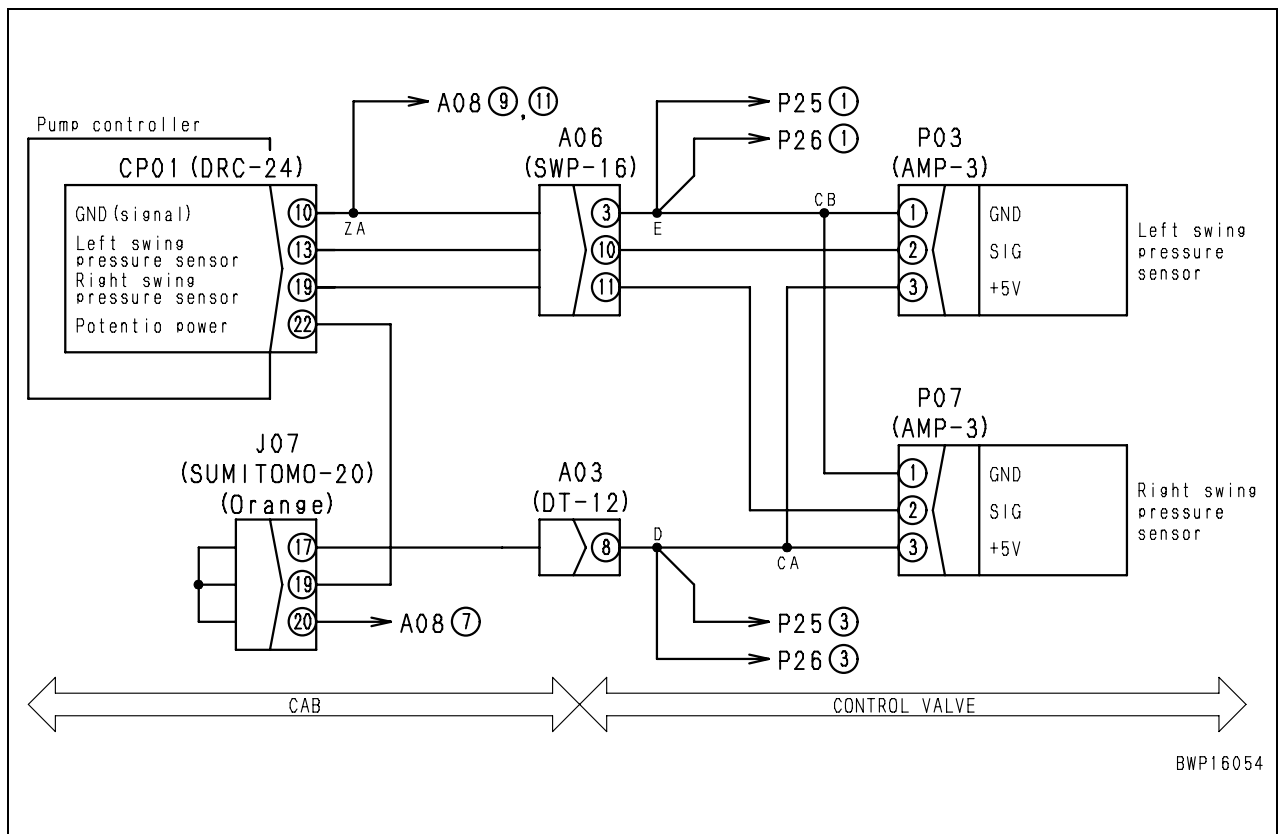


E-24 Monitoring function fails to display "swing right" normally

Trouble	<ul style="list-style-type: none"> Monitoring function (special function) of machine monitor fails to display "swing right" normally.
Related information	<ul style="list-style-type: none"> If failure code DHSAMA is displayed, carry out troubleshooting for it first. Monitoring code: 09002 (Swing right PPC pressure)

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective swing right PPC pressure sensor (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			P07		Voltage	
			Between (3) – (1)		4.5 – 5.5 V	
			Between (2) – (1)		0.5 – 4.5 V	
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CP01 (female) (19) – A06 – P07 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between CP01 (female) (22) – A03 – P07 (female) (3)		Resistance	Max. 1 Ω
			Wiring harness between CP01 (female) (10) – A06 – P07 (female) (1)		Resistance	Max. 1 Ω
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CP01 (female) (19) – A06 – P07 (female) (2)		Resistance	Min. 1 MΩ
			Wiring harness between CP01 (female) (22) – A03 – P07 (female) (3)		Resistance	Min. 1 MΩ
	4	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between CP01 (female) (19) – A06 – P07 (female) (2)		Voltage	Max. 1 V
			Wiring harness between CP01 (female) (22) – A03 – P07 (female) (3)		Voltage	Max. 1 V
	5	Defective pump controller	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			CP01	Swing lever	Voltage	
			Between (22) – (10)		Neutral	4.5 – 5.5 V
			Between (19) – (10)		Operate right	0.5 – 4.5 V

Circuit diagram related

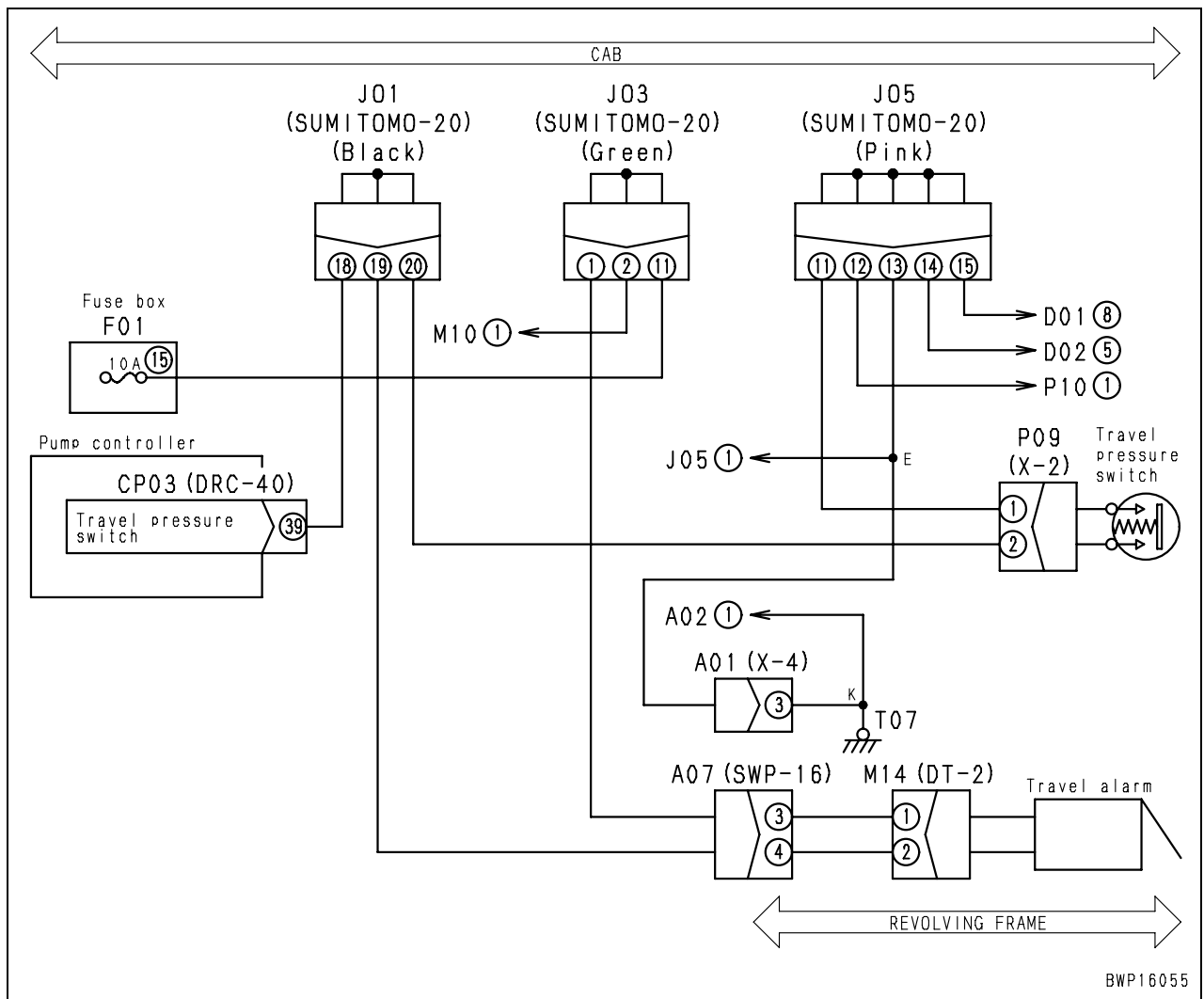


E-25 Monitoring function fails to display “travel” normally

Trouble	• Travel is not displayed normally by machine monitoring function (Special functions)
Related information	• Monitoring code: 01900 (Pressure Switch 1)

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective travel PPC oil pressure switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			P09 (male)		Travel lever	Resistance
			Between (1) – (2)	Neutral	Min. 1 MΩ	
				Forward or reverse	Max. 1 Ω	
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CP03 (female) (39) – J01 – P09 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between P09 (female) (1) – J05 – A01 – chassis ground (T07)		Resistance	Max. 1 Ω
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness of CP03 (female) (39) – J01 – P09 (female) (2) – M14 (female) (2) and chassis ground (T07)		Resistance	Min. 1 MΩ
	4	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness of CP03 (female) (39) – J01 – P09 (female) (2) – M14 (female) (2) and chassis ground (T07)		Voltage	Max. 1 V
	5	Defective pump controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			CP03	Travel lever	Voltage	
			Between (39) – chassis ground (T07)	Neutral	20 – 30 V	
				Forward or reverse	Max. 1 V	

Circuit diagram related

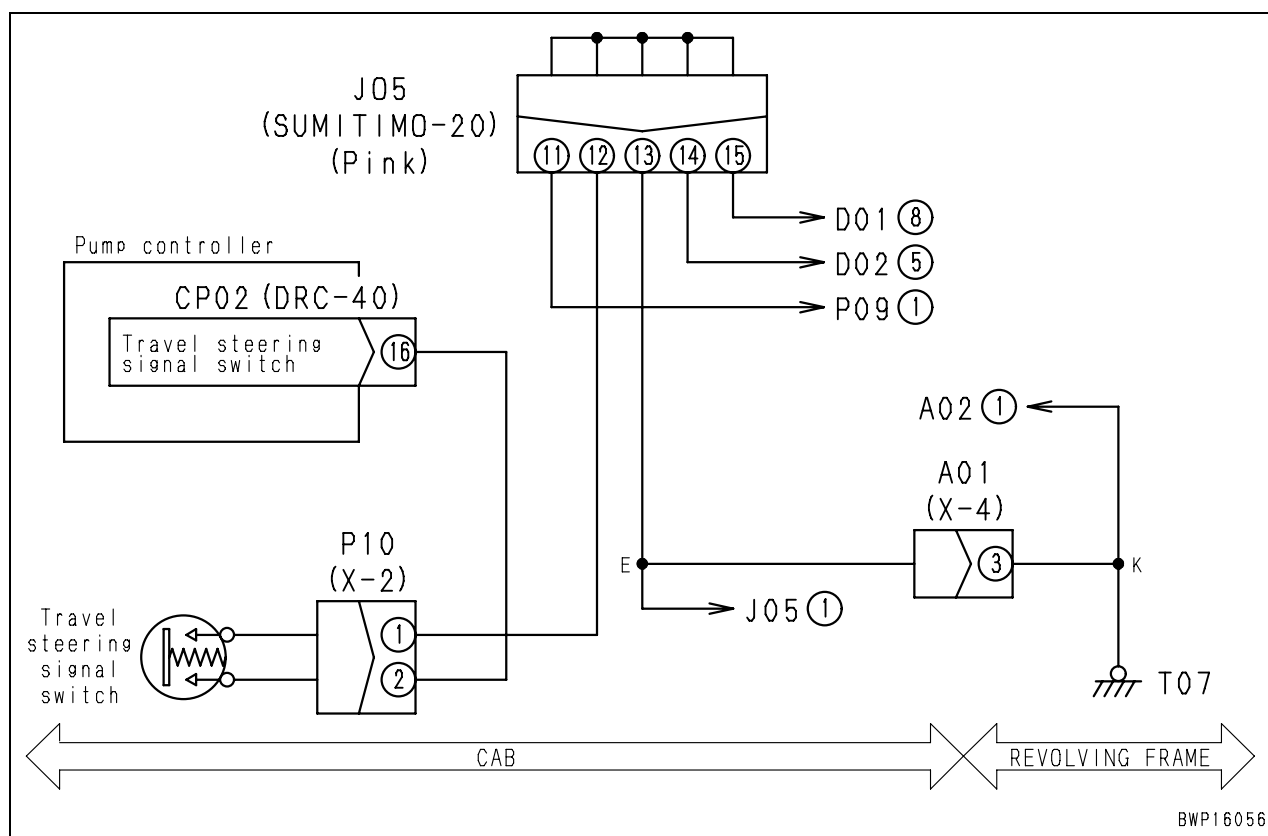


E-26 Monitoring function fails to display “travel differential pressure” normally

Trouble	<ul style="list-style-type: none"> Travel differential pressure is not displayed normally by machine monitoring function (Special functions)
Related information	<ul style="list-style-type: none"> Travel differential pressure is turned on as a pressure difference occurred between the right and left travel PPC circuits (during steering). Monitoring code: 01901 (Pressure Switch 2)

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective travel steering PPC oil pressure switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			P10 (male)		Travel lever	Resistance
			Between (1) – (2)	Neutral	Min. 1 MΩ	
				Left or right only	Max. 1 Ω	
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CP02 (female) (16) – P10 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between P10 (female) (1) – J05 – A01 – chassis ground (T07)		Resistance	Max. 1 Ω
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CP02 (female) (16) – P10 (female) (2) and chassis ground (T07)		Resistance	Min. 1 MΩ
	4	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between CP02 (female) (16) – P10 (female) (2) and chassis ground (T07)		Voltage	Max. 1 V
	5	Defective pump controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			CP02		Travel lever	Voltage
			Between (16) – chassis ground (T07)	Neutral	20 – 30 V	
				Left or right only	Max. 1 V	

Circuit diagram related

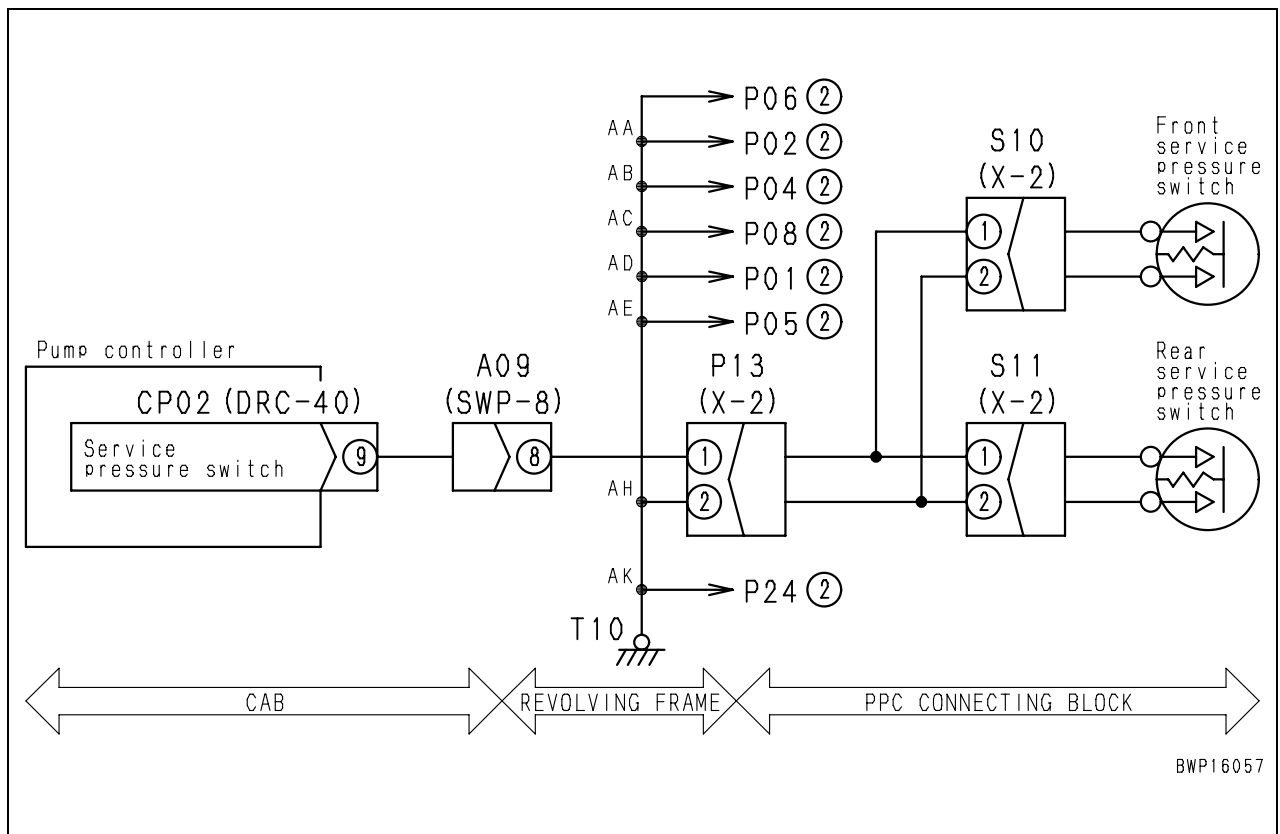


E-27 Monitoring function fails to display “service” normally

Trouble	• Service is not displayed normally by machine monitoring function (Special functions)
Related information	• Monitoring code: 01901 (Pressure Switch 2)

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Defective service (front) PPC oil pressure switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			S10 (male)		Service pedal	Resistance
			Between (1) – (2)	Neutral	Min. 1 MΩ	
				Front	Max. 1 Ω	
	2	Defective service (rear) PPC oil pressure switch (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.			
			S11(male)		Service pedal	Resistance
			Between (1) – (2)	Neutral	Min. 1 MΩ	
				Rear	Max. 1 Ω	
	3	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CP02 (female) (35) – A09 – P13 – S10 (female) (1), – S11 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between S10 (female) (2) – chassis ground (T10)		Resistance	Max. 1 Ω
			Wiring harness between S11 (female) (2) – chassis ground (T10)		Resistance	Max. 1 Ω
	4	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.			
			Wiring harness between CP02 (female) (35) – A09 – P13 – S10 (female) (1), – S11 (female) (1) and chassis ground (T10)		Resistance	Min. 1 MΩ
	5	Hot short (Short circuit with 24V circuit) in wiring harness	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.			
			Wiring harness between CP02 (female) (35) – A09 – P13 – S10 (female) (1), – S11 (female) (1) and chassis ground (T10)		Voltage	Max. 1 V
6	Defective pump controller	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.				
		CP02		Service pedal	Voltage	
		Between (35) – chassis ground (T10)	Neutral	20 – 30 V		
			Front or rear	Max. 1 V		

Circuit diagram related



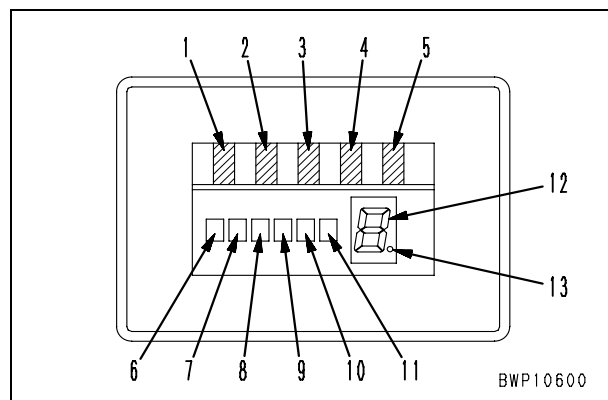
E-28 KOMTRAX system does not operate normally

Trouble	<ul style="list-style-type: none"> KOMTRAX system does not operate normally.
Related information	<ul style="list-style-type: none"> If KOMTRAX system administrator makes request for checking system on machine side for trouble, carry out following troubleshooting. Even if KOMTRAX system has trouble, it does not particularly appear on machine.

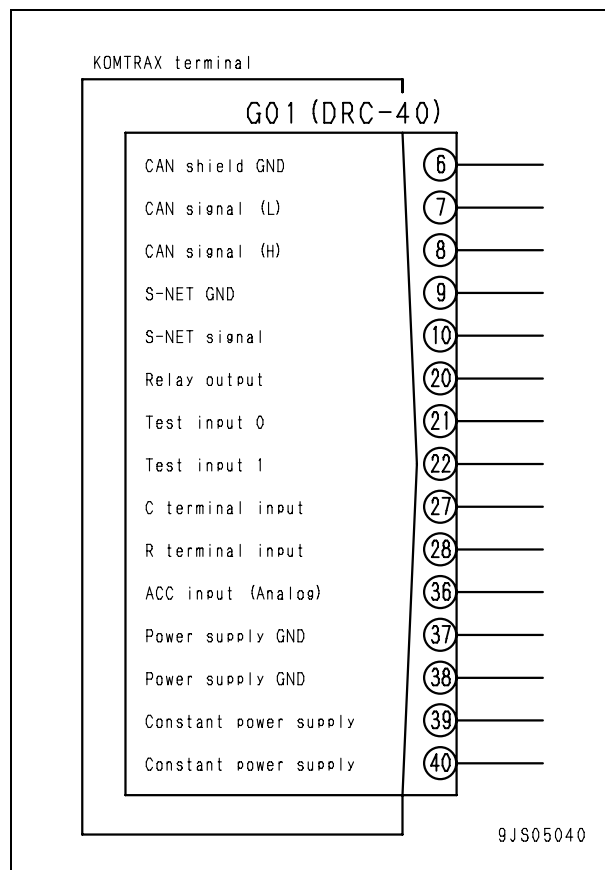
Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective power supply	★ Turn starting switch OFF, then carry out troubleshooting.		
			LED (1)		Normal state
			LED-A1		Lighted up
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			G01	Signal	Voltage
			Between (39), (40) – (37), (38)	Constant power supply	20 – 30 V
	2	Defective GPS	★ Turn starting switch ON and carry out troubleshooting.		
			LED (2)		Normal state
			LED-A2		Lighted up
	3	Defective starting switch ACC signal and alternator R signal	★ Start engine and carry out troubleshooting.		
			LED (6)		Normal state
			LED-C1		Lighted up
			★ Prepare with starting switch OFF, then start engine and carry out troubleshooting.		
			G01	Signal	Voltage
			Between (36) – (37), (38)	Starting switch ACC	20 – 30 V
	4	Defective starting switch C signal	★ Turn starting switch ON and carry out troubleshooting.		
			LED (8)		Normal state
			LED-C3		Lighted up
			★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			G01	Signal	Voltage
			Between (27) – (37), (38)	Starting switch C	Max. 1 V
	5	State of CAN connection	★ Turn starting switch ON and carry out troubleshooting.		
			LED (9)		Normal state
			LED-C4		Lighted up
			★ Prepare with starting switch OFF and carry out troubleshooting.		
			G01	Signal	Resistance
			Between (7) – (8)	CAN	40 – 80 Ω
6	Number of mails not transmitted yet	★ Turn starting switch ON and carry out troubleshooting.			
		LED (12)		Normal state	
		7-segment		0 – 9	

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting	
	7	State of positioning with GPS	★ Turn starting switch ON and carry out troubleshooting (See *)	
			LED (13)	Normal state
			Dot	ON
			* In an outdoor location within radio waves' penetration range, it sometimes takes more than a minute from turning on of the starting switch to completion of the positioning.	

LED display unit



G01 connector

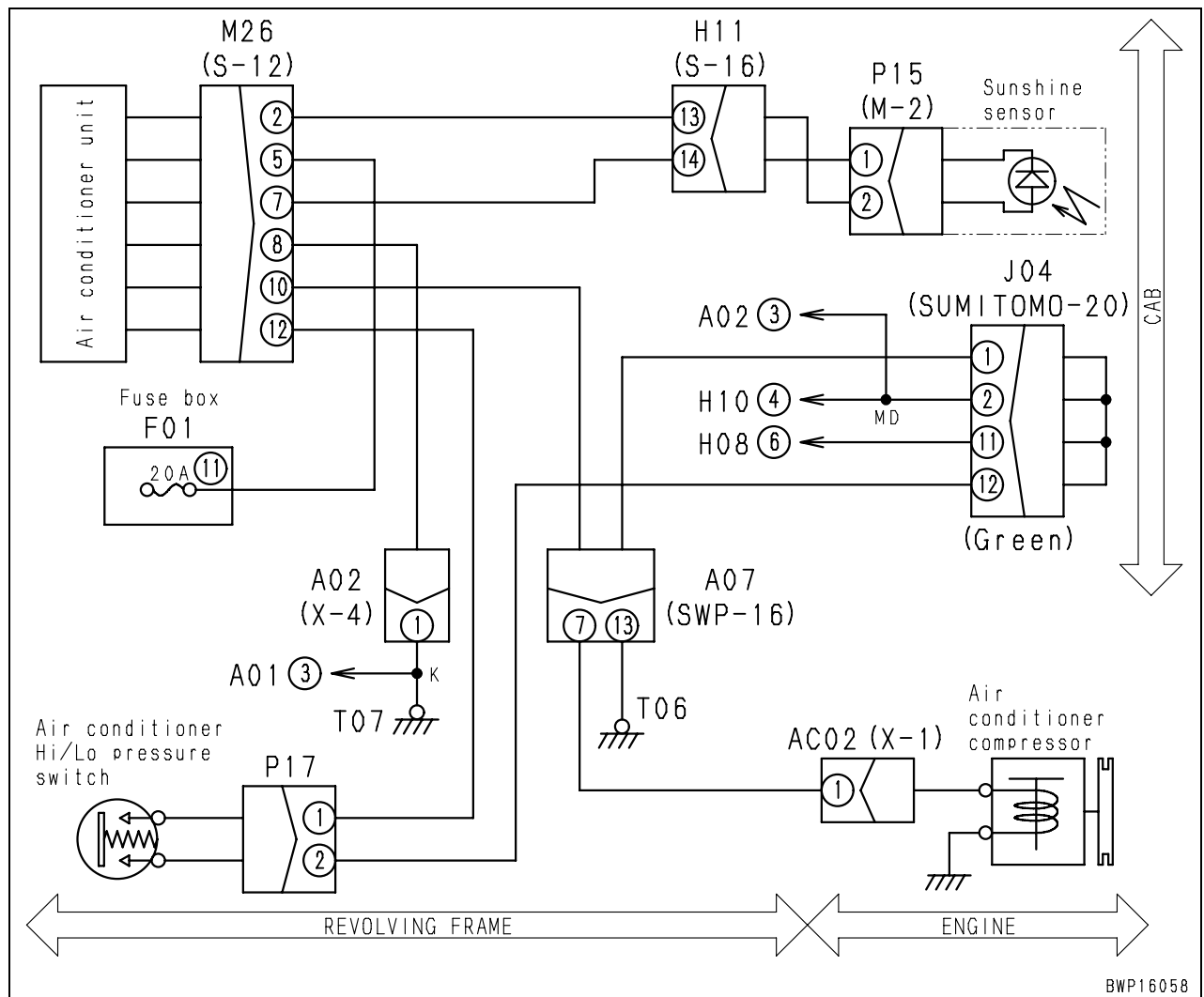


E-29 Air conditioner does not operate

Trouble	<ul style="list-style-type: none"> Air conditioner does not operate.
Related information	<ul style="list-style-type: none"> For electrical circuit inside the air conditioner unit, refer to the structure, function and maintenance standard, "Air conditioner system."

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective fuse No. 11	If fuse is burnt, circuit probably has ground fault.		
	2	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between F01(11) outlet – M26 (female) (5)	Resistance	Max. 1 Ω
			Wiring harness between M26 (female) (8) – A02 (female) (1) – chassis ground (T07)	Resistance	Max. 1 Ω
			Wiring harness between M26 (female) (10) – A07 – AC02 (female) (1)	Resistance	Max. 1 Ω
	3	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between F01(11) outlet – M26 (female) (5) and chassis ground (T07)	Resistance	Min. 1 MΩ
	4	Defective air conditioner unit	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting. (The table indicates internal defect of an air conditioner)		
			M26	Voltage	
			Between (2), (5), (7), (10), (12) – (8)	20 – 30 V	

Circuit diagram related

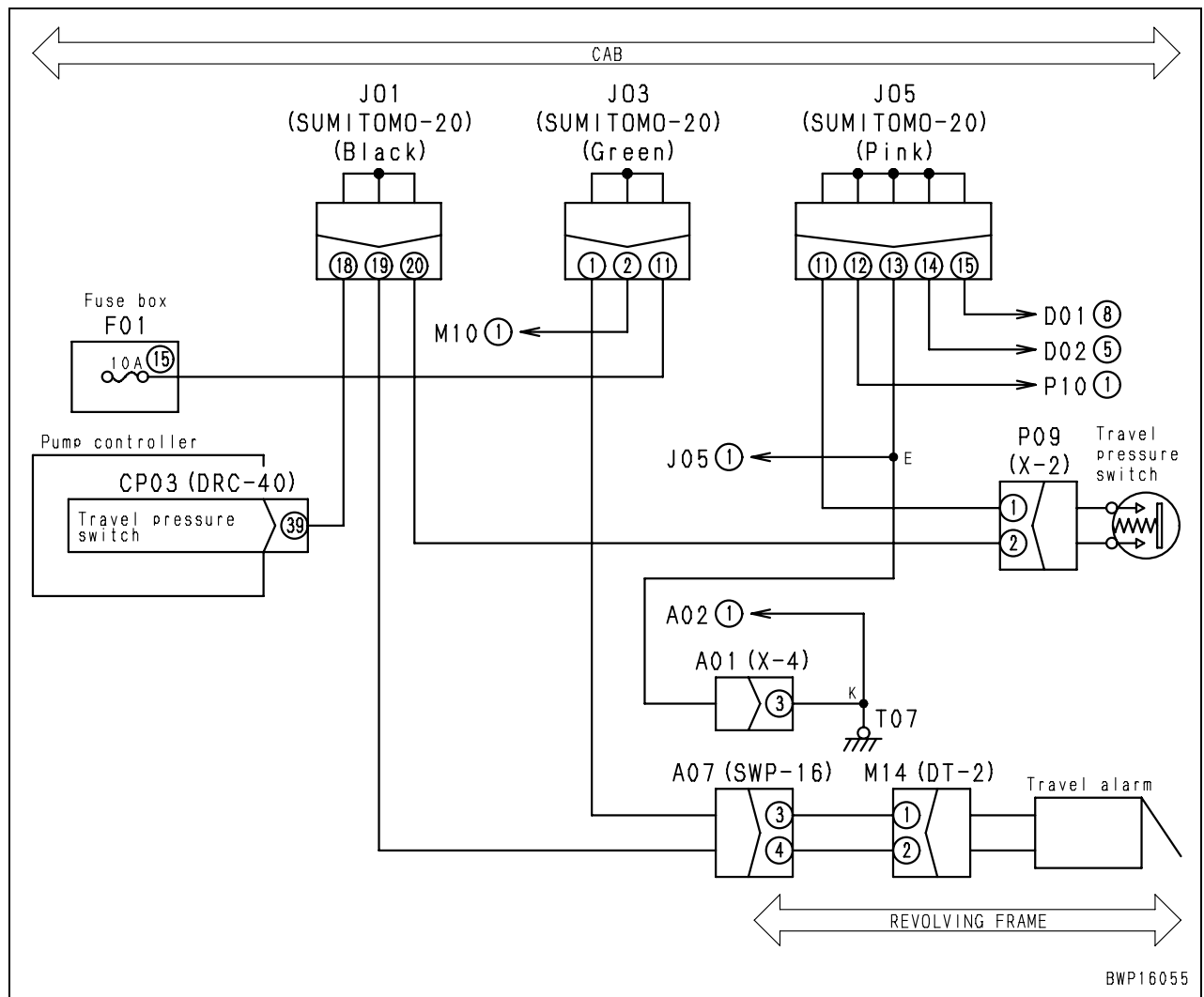


E-30 Travel alarm does not sound or does not stop sounding

Trouble	<ul style="list-style-type: none"> Alarm does not sound during travel. Alarm sounds in stopped state.
Related information	<ul style="list-style-type: none"> Carry out troubleshooting when monitoring function displays "travel" normally. (If display is abnormal, carry out troubleshooting for "E-25" first.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective fuse No. 15	If fuse is burnt out, the circuit probably has ground fault.		
	2	Defective travel signal	In the case monitoring is not normally indicated, proceed to troubleshooting No. E-25.		
			Monitoring code	Item	Normal display
			01900 (Pressure switch 1)	Travel	Operation of lever: ON Lever in neutral: OFF
			When the monitoring display is not correct, proceed to diagnosis for "Travel is not normally indicated" in the monitoring function		
	3	Defective travel alarm (Internal disconnection or short circuit)	★ Prepare with starting switch OFF, then start engine and carry out troubleshooting (insert T-adapter).		
			M14	Travel lever	Voltage
			Between (1) – (2)	Neutral	Max. 1 V
				Operated	20 – 30 V
	4	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between F01(15) outlet – J03 – A07 – M14 (female) (1)		Resistance Max. 1 Ω
			Wiring harness between M14 (female) (2) – A07 – J01 (19)		Resistance Max. 1 Ω
	5	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between F01(15) outlet – J03 – A07 – M14 (female) (1) and chassis ground (T07)		Resistance Min. 1 MΩ

Circuit diagram related

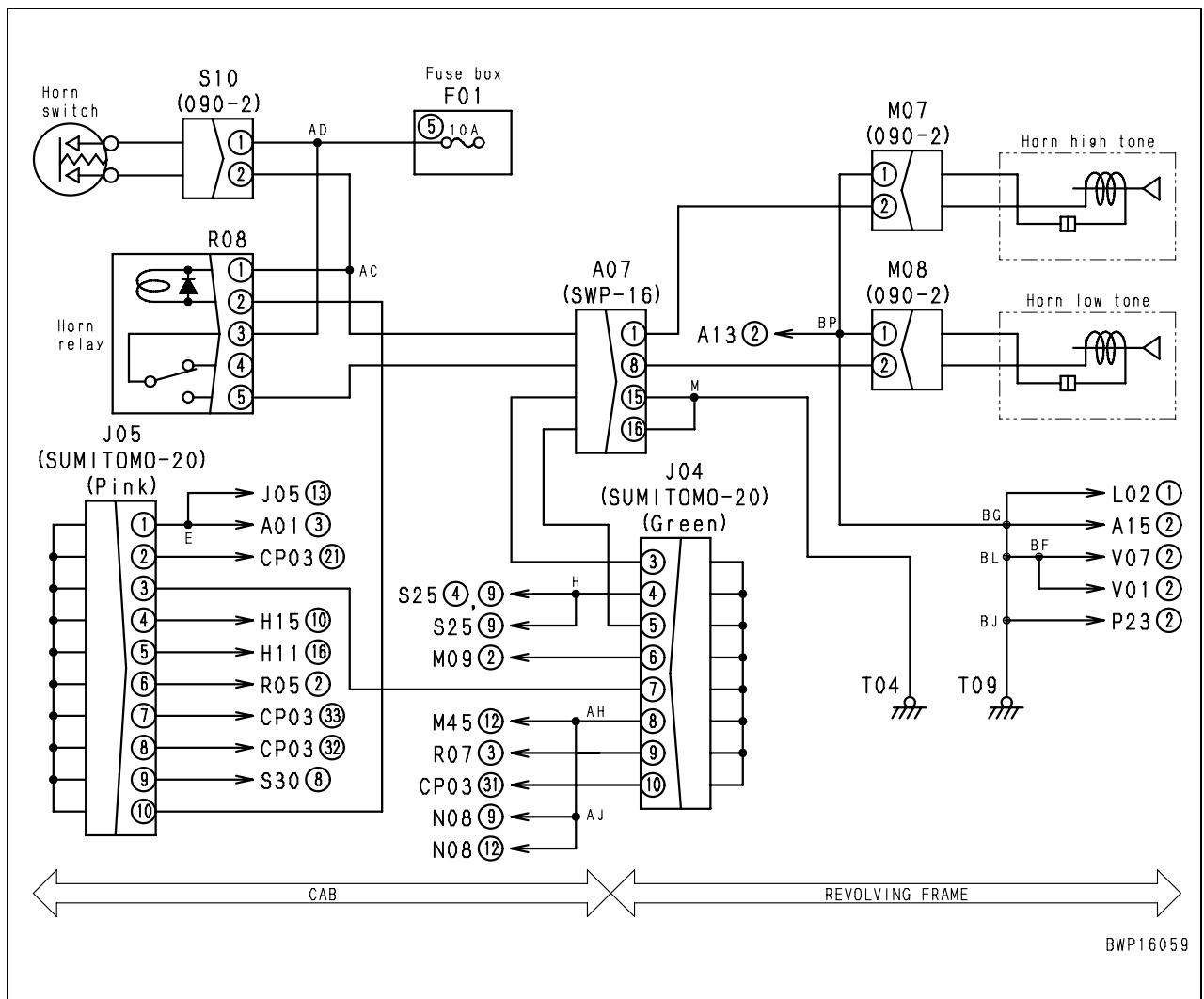


E-31 Horn does not sound

Trouble	Horn does not sound
Related information	

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Defective fuse F01-(5)	If fuse is broken, circuit probably has ground fault. (See Cause 6)		
	2	Defective horn relay	If the horn sounds after replacing the relay, the relay was defective		
	3	Defective high tone horn	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Between M07 (2) – chassis ground (T04) (with horn switch turned ON)	Voltage	20 – 30 V
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Between M07 (female) (1) – chassis ground (T09)	Resistance	Max. 1 Ω
			If above is normal, the horn is defective		
	4	Defective low tone horn	★ Prepare with starting switch OFF, then turn starting switch ON and carry out troubleshooting.		
			Between M08 (2) – chassis ground (T04) (with horn switch turned ON)	Voltage	20 – 30 V
			★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Between M08 (female) (1) – chassis ground (T09)	Resistance	Max. 1 Ω
			If above is normal, the horn is defective		
	5	Disconnection in wiring harness (Disconnection in wiring or defective contact in connector)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between F01 (5) – S10 (female) (1) – R08 (female) (3)	Resistance	Max. 1 Ω
			Wiring harness between S10 (female) (2) – R08 (female) (1) – A07 – M07 (female) (2)	Resistance	Max. 1 Ω
			Wiring harness between R08 (female) (5) – A07 – M08 (female) (2)	Resistance	Max. 1 Ω
			Wiring harness between R08 (female) (2) – J05 (male) (3) – J04 – A07 – chassis ground (T04)	Resistance	Max. 1 Ω
	6	Ground fault in wiring harness (Short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting without turning starting switch ON.		
			Wiring harness between F01 (5) – S10 (female) (1) – R08 (female) (3) and chassis ground	Resistance	Min. 1 MΩ
			Wiring harness between S10 (female) (2) – R08 (female) (1) – A07 – M07 (female) (2) and chassis ground (T04)	Resistance	Min. 1 MΩ
			Wiring harness between R08 (female) (5) – A07 – M08 (female) (2) and chassis ground (T09)	Resistance	Min. 1 MΩ

Circuit diagram related

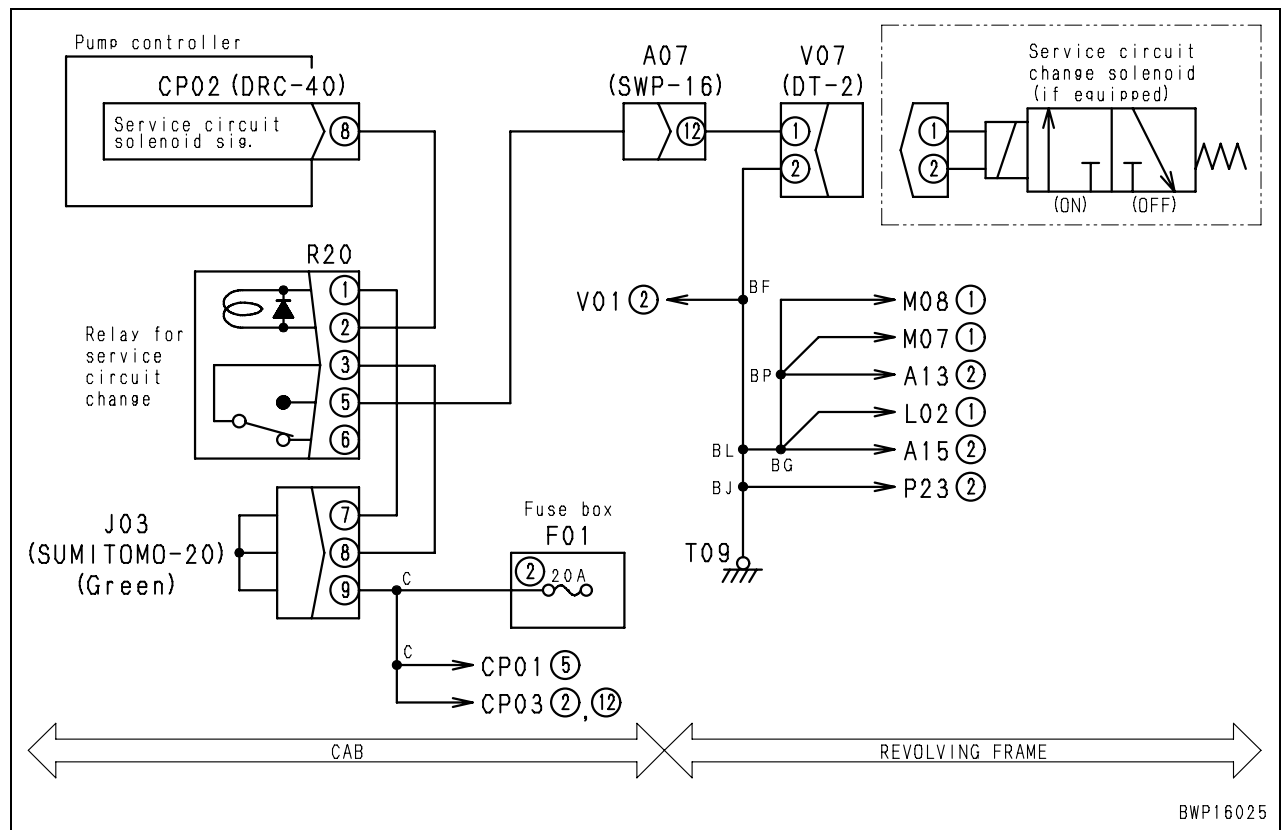


E-32 Attachment circuit does not change

Trouble	<ul style="list-style-type: none"> Attachment circuit does not change. 	(1) When working mode P or E is selected, attachment circuit is not switched to crusher circuit (reciprocation circuit). (2) When working mode B is selected, attachment circuit is not switched to breaker circuit (one-way circuit).
Related information	<ul style="list-style-type: none"> If the primary side (coil side) of the attachment return selector relay has a fault (short-circuit or disconnection), an error code is displayed. A fault on the secondary side (contact side) cannot be detected, however. 	

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting			
	1	Attachment return selector solenoid defective (Internal disconnection or short-circuit)	★ Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			V07 (male)		Resistance	
			Between (1) and (2)		20 – 60 Ω	
			Between (1) and chassis ground		Min. 1 MΩ	
	2	Attachment return selector relay defective (Internal disconnection or short-circuit)	★ Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			R20 (male)		Resistance value	
			Between (3) and (4)		Max. 1 Ω	
			Between (3) and (5)		Min. 1 MΩ	
	3	Disconnection of wiring harness (Disconnection or defective contact with connector)	★ Turn the engine starting switch OFF for the preparations, and hold it in the OFF position during the troubleshooting.			
			Wiring harness between CP02 (female) (8) and R20 (female) (2)		Resistance	Max. 1 Ω
			Wiring harness between R20 (female) (5) and V07 (female) (1)		Resistance	Max. 1 Ω
			Wiring harness between V07 (female) (2) – and chassis ground (T09)		Resistance	Max. 1 Ω
	4	Short-circuit of wiring harness (Contact with 24 V circuit)	★ Turn the engine starting switch OFF for the preparations, and hold it in the ON position during the troubleshooting.			
			Between wiring harness and R20 (female) (5) and V07 (female) (1) and chassis ground (T09)		Voltage	Max. 1 V

Circuit diagram related



PC160LC-7E0, PC180LC/NLC-7E0 Hydraulic excavator

Form No. UEN02117-00

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Printed in Belgium 09-07 (02)

HYDRAULIC EXCAVATOR

PC160LC-7E0

PC180LC-7E0

PC180NLC-7E0

Machine model Serial number

PC160LC-7E0	K45001 and up
PC180LC-7E0	K45001 and up
PC180NLC-7E0	K45001 and up

40 Troubleshooting

Troubleshooting of hydraulic and mechanical system (H-mode)

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Information contained in troubleshooting table

- ★ Troubleshooting table collectively carry the following information. Carry out troubleshooting work after fully grasping their contents.

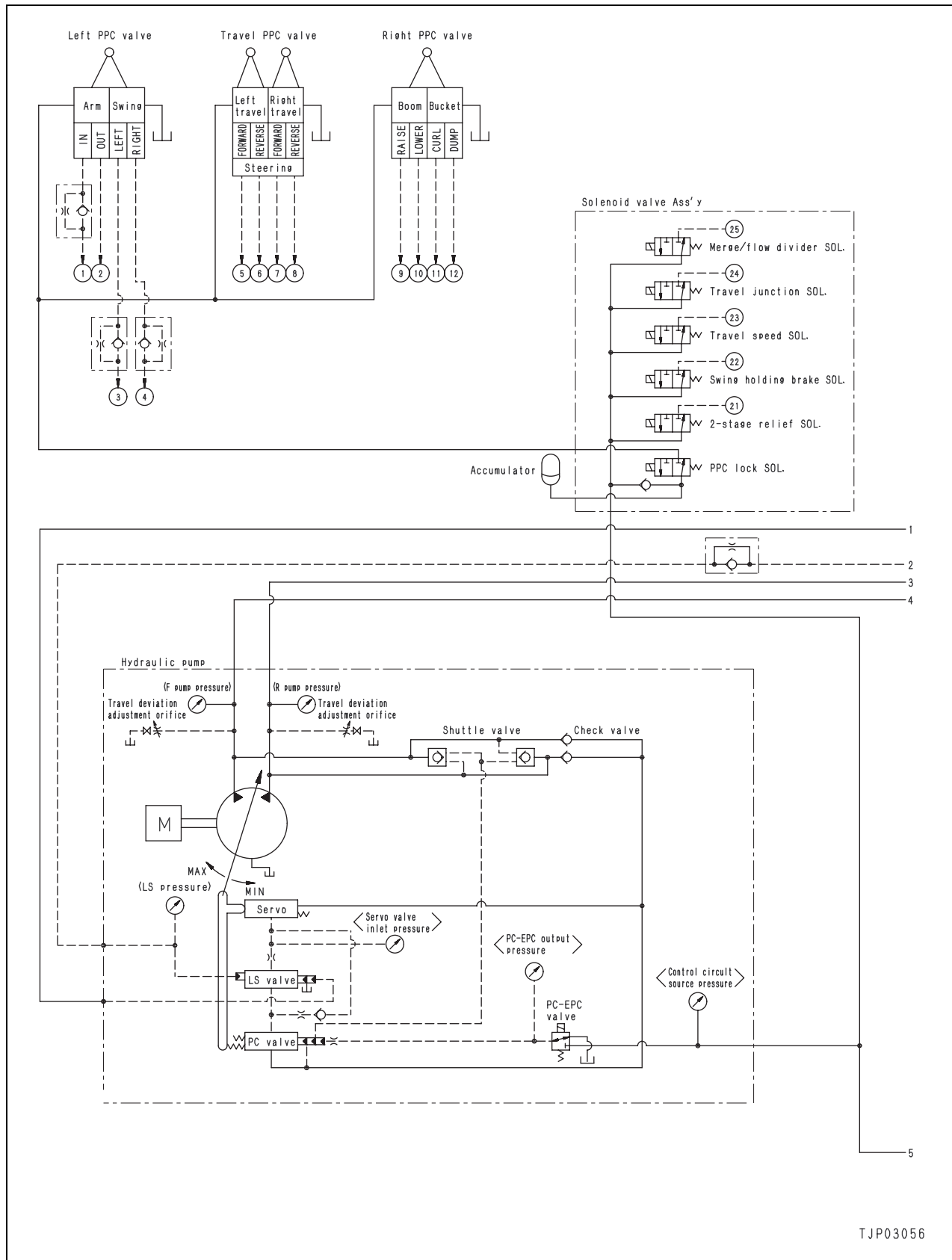
Trouble	Phenomena occurring on machine
Related information	Information on occurred failures and troubleshooting

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Cause for presumed failure (The attached No. for filing and reference purpose only. It does not stand for any priority)	<Contents> <ul style="list-style-type: none">• The standard values in normalcy by which to judge "good" or "no good" about presumed causes.• References for making judgement of "good" or "no good"
	2		
	3		
	4		
	5		

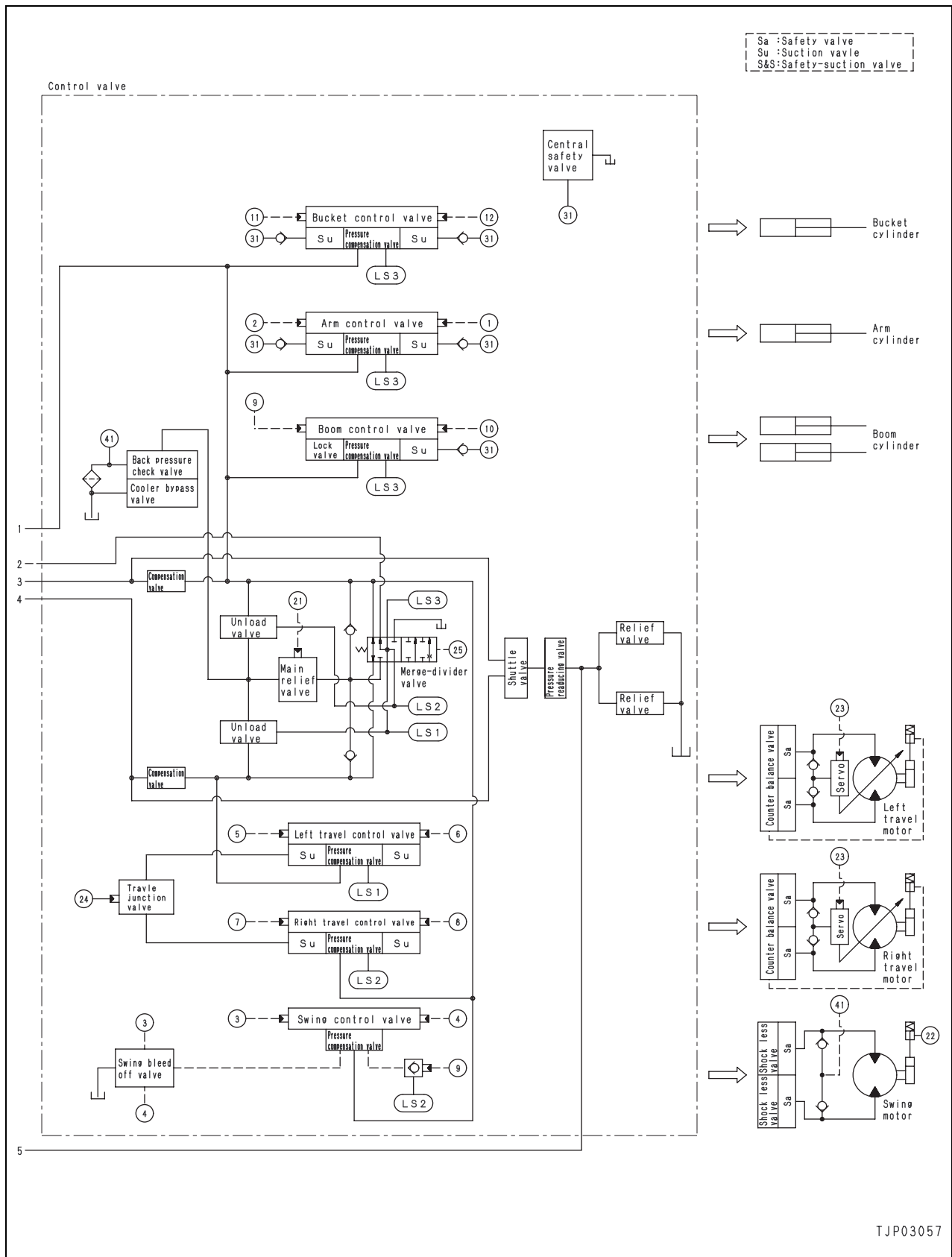
<Contents>

- The standard values in normalcy by which to judge "good" or "no good" about presumed causes.
- References for making judgement of "good" or "no good"

System chart for hydraulic and mechanical systems



- ★ This is a system chart that has been drawn up by simplifying the whole hydraulic circuit chart. Use it as a reference material when troubleshooting the hydraulic and mechanical systems.



H-1 Speed or power of all work equipment, swing, and travel are low

Trouble	• Speed or power of all work equipment, swing, and travel are low.
Related information	• Conduct the troubleshooting in working mode P.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Malfunction of unload valve	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.		
			Control levers	Hydraulic oil temperature	Unload pressure
			All levers in NEUTRAL	Approx. 50°C	Below 5.9 MPa {Below 60 kg/cm²}
				Approx. 80°C	Below 7.4 MPa {Below 75 kg/cm²}
	2	Defective adjustment or operation of main relief valve	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.		
			Control lever		Main relief pressure
			Arm lever in IN direction	Normal relief	33.3 – 36.8 MPa {340 – 375 kg/cm²}
				Power max.	36.3 – 39.2 MPa {370 – 400 kg/cm²}
			If the oil pressure cannot be set normally by adjustment, the main relief valve may be malfunction or may have an internal defect. Check the main relief valve directly.		
	3	Malfunction of self-pressure reducing valve	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.		
			Control levers	Control circuit basic pressure	
			All levers in NEUTRAL	2.84 – 3.43 MPa {29 – 35 kg/cm²}	
	4	Defective adjustment or operation of PC valve	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.		
			Measured oil pressure	Measurement conditions	Oil pressure ratio
			Pump discharge pressure	Swing lock: ON Arm: Relieved in IN direction	1
			PC valve output pressure		Approx. 0.6 (Approx. 3/5)
			If the oil pressure cannot be set normally by adjustment, the PC valve may be malfunction or may have an internal defect. Check the PC valve directly.		
			5	Defective adjustment or operation of LS valve	Measured oil pressure
	All levers in NEUTRAL	Bucket curled (Lever at stroke end)			
	Pump discharge pressure	Almost same pressure			1
	LS valve output pressure				Approx. 0.6 (Approx. 3/5)
	If the oil pressure cannot be set normally by adjustment, the LS valve may be malfunction or may have an internal defect. Check the LS valve directly.				
	6	Malfunction of servo piston	The servo piston may have malfunction. Check it directly.		
7	Piston pump defective	If there is none of the causes listed above, the piston pump may have problems of lowering of performance, malfunction, internal defect, etc.			

H-2 Engine speed sharply drops or engine stalls

Trouble	• Engine speed sharply drops or the engine stalls.				
Related information	• Conduct the troubleshooting in working mode P.				

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Defective adjustment or operation of main relief valve	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.		
			Control lever		Main relief pressure
			Arm lever in IN direction	Normal relief	33.3 – 36.8 MPa {340 – 375 kg/cm²}
				Power max.	36.3 – 39.2 MPa {370 – 400 kg/cm²}
			If the oil pressure cannot be set normally by adjustment, the main relief valve may be malfunction or may have an internal defect. Check the main relief valve directly.		
	2	Defective adjustment or operation of PC valve	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.		
			Measured oil pressure	Measurement conditions	Oil pressure ratio
			Pump discharge pressure	Swing lock: ON Arm: Relieved in IN direction	1
			PC valve output pressure		Approx. 0.6 (Approx. 3/5)
			If the oil pressure cannot be set normally by adjustment, the PC valve may be malfunction or may have an internal defect. Check the PC valve directly.		
	3	Defective adjustment or operation of LS valve	Measured oil pressure	Oil pressure ratio	
				All levers in NEUTRAL	Bucket curled (Lever at stroke end)
			Pump discharge pressure	Almost same pressure	1
			LS valve output pressure		Approx. 0.6 (Approx. 3/5)
			If the oil pressure cannot be set normally by adjustment, the LS valve may be malfunction or may have an internal defect. Check the LS valve directly.		
	4	Orifice or filter in servo equipment clogged	The orifice or filter in the pump servo equipment is suspected of clogging. Check the equipment itself.		
	5	Malfunction of servo piston	The servo piston may have malfunction. Check it directly.		

H-3 No work equipment, travel and swing move

Trouble	• No work equipment, travel and swing move.
Related information	• Set the working mode at P mode for the troubleshooting.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting	
	1	Malfunction of PPC lock solenoid valve	★ Stop engine for preparations. Start troubleshooting at engine high idle.	
			Work equipment lock lever	Solenoid output pressure
			Locked	0 MPa {0 kg/cm ² }
			Released	2.84 – 3.43 MPa {29 – 35 kg/cm ² }
	2	Malfunction of self reducing pressure valve	★ Stop engine for preparations. Start troubleshooting at engine high idle.	
			Control lever	Control circuit source pressure
			All control levers in NEUTRAL position	2.84 – 3.43 MPa {29 – 35 kg/cm ² }
	3	Piston pump defective	The piston pump is suspected of malfunction or an internal failure. Diagnose it in the following manner. • Remove the main oil pressure measurement plug and crank the engine. If oil flows out, it is in normal condition.	
	4	Damper defective	It is presumed that the pump shaft does not rotate due to some internal failure of the dumper. Check the damper itself.	

H-4 Abnormal noise is heard from around hydraulic pump

Trouble	• An abnormal noise is heard from around the hydraulic pump.
Related information	—

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Hydraulic oil level lowered	Make a visual check.
	2	Quality of hydraulic oil bad	Air may have get mixed with the oil. Make a visual check.
	3	Hydraulic tank cap breather clogged	It is presumed that the breather in the cap of hydraulic tanks is clogged, thereby causing negative pressure inside the tank. Make a visual check.
	4	Hydraulic tank strainer clogged	It is presumed that the strainer in the hydraulic tank is clogged, thereby causing negative pressure in the suction circuit. Make a visual check.
	5	Piston pump defective	The piston pump is suspected of an internal failure. Check the pump itself.

H-5 Auto-decelerator does not work

Trouble	• Auto-decelerator does not work.		
Related information	• This troubleshooting mode is applied when the auto-decelerator does not work, while operating the travel control lever. (A shuttle valve is provided between PPC valve and the hydraulic switch only in the travel circuit -actually located inside PPC valve) • Set the working mode at P mode for the troubleshooting.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting	
	1	Malfunction of travel PPC valve (shuttle valve)	★ Stop engine for preparations. Start troubleshooting at engine high idle.	
			Travel control lever	PPC valve output pressure
			NEUTRAL	0 MPa {0 kg/cm²}
			Operation	Above 2.7 MPa {Above 28 kg/cm²}

H-6 Fine control mode does not function

Trouble	• Fine control mode does not function.			
Related information	• Set the working mode at P mode for the troubleshooting.			

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Orifice in LS circuit clogged	The orifice in the LS circuit is presumed to be clogged. Check the orifice itself.		
	2	Defective adjustment or malfunction of LS valve	★ Stop engine for preparations. Start troubleshooting at engine high idle.		
			Oil pressure to be measured	Oil pressure ratio	
				All control levers in NEUTRAL	At bucket CURL (Control lever full stroke)
			Pump delivery pressure	Nearly equal oil pressure	1
			LS valve output pressure		Approx. 0.6 (Approx. 3/5)
					If the oil pressure does not return to normalcy even after the adjustment, malfunction of the LS valve or its internal failure is suspected. In that case, check the valve itself.
	3	Malfunction of servo piston	Malfunction of the servo piston is suspected. Check the piston itself.		

H-7 Speed or power of boom is low

Trouble	• Speed or power of boom is low.
Related information	• Conduct the troubleshooting in working mode P.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting	
	1	Malfunction of right PPC valve (boom circuit)	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.	
			Right work equipment control lever	PPC valve output pressure
			NEUTRAL	0 MPa {0 kg/cm ² }
			Boom RAISE position Boom LOWER position	Above 2.7 MPa {Above 28 kg/cm ² }
	2	Malfunction of pump merge-divider solenoid valve	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.	
			Control levers	Solenoid output pressure
			All levers in NEUTRAL	0 MPa {0 kg/cm ² }
	3	Malfunction of pump merge-divider valve	Position for travel only (On either or both sides)	2.84 – 3.43 MPa {29 – 35 kg/cm ² }
			The pump merge-divider valve of the control valve may have a malfunction. Check it directly.	
	4	Malfunction of boom control valve (spool)	The spool of the boom control valve may have a malfunction. Check it directly (Including stroke limiting mechanism on RAISE side).	
	5	Malfunction of boom control valve (pressure compensation valve)	The pressure compensation valve of the boom control valve may have a malfunction. Check it directly.	
	6	Malfunction or defective sealing of boom control valve (regeneration valve)	The regeneration valve of the boom control valve may have a malfunction or its sealing may be defective. Check it directly.	
	7	Malfunction of boom control valve (lock valve)	The lock valve of the boom control valve may have a malfunction. Check it directly.	
	8	Malfunction or defective sealing of boom control valve (safety-suction valve)	The safety-suction valve of the boom control valve (on the head side) may have a malfunction or its sealing may be defective. Check it directly.	
	9	Malfunction or defective sealing of boom control valve (suction valve)	The suction valve of the boom control valve (on the bottom side) may have a malfunction or its sealing may be defective. Check it directly.	
	10	Malfunction or defective sealing of centralized safety-suction valve	The centralized safety-suction valve of the control valve may have a malfunction or its sealing may be defective. Check it directly.	
	11	Boom cylinder defective	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.	
			Boom cylinder	Leakage from cylinder
			Relieved in RAISE direction	20 cc/min

H-8 Speed or power of arm is low

Trouble	• Speed or power of arm is low.		
Related information	• Conduct the troubleshooting in working mode P.		
Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Malfunction of left PPC valve (arm circuit)	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.
			Left work equipment control lever
			PPC valve output pressure
			NEUTRAL
			0 MPa {0 kg/cm ² }
			Arm IN position
			Above 2.7 MPa {Above 28 kg/cm ² }
			Arm OUT position
	2	Malfunction of pump merge-divider solenoid valve	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.
			Control levers
			Solenoid output pressure
			All levers in NEUTRAL
			0 MPa {0 kg/cm ² }
			Position for travel only (On either or both sides)
			2.84 – 3.43 MPa {29 – 35 kg/cm ² }
	3	Malfunction of pump merge-divider valve	The pump merge-divider valve of the control valve may have a malfunction. Check it directly.
	4	Malfunction of arm control valve (spool)	The spool of the arm control valve may have a malfunction. Check it directly (Including stroke limiting mechanisms on IN side and OUT side).
	5	Malfunction of arm control valve (pressure compensation valve)	The pressure compensation valve of the arm control valve may have a malfunction. Check it directly.
	6	Malfunction of arm control valve (lock valve) [When lock valve is installed]	The lock valve of the arm control valve may have a malfunction. Check it directly.
	7	Malfunction or defective sealing of arm control valve (safety-suction valves)	The safety-suction valves of the arm control valve (on the bottom side and head side) may have a malfunction or their sealing may be defective. Check them directly.
	8	Malfunction or defective sealing of centralized safety-suction valve	The centralized safety-suction valve of the control valve may have a malfunction or its sealing may be defective. Check it directly.
	9	Arm cylinder defective	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.
			Arm cylinder
			Leakage from cylinder
			Relieved in IN direction
			20 cc/min

H-9 Speed or power of bucket is low

Trouble	• Speed or power of bucket is low.
Related information	• Conduct the troubleshooting in working mode P.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting	
	1	Malfunction of right PPC valve (bucket circuit)	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.	
			Right work equipment control lever	PPC valve output pressure
			NEUTRAL	0 MPa {0 kg/cm ² }
			Bucket CURL position Bucket DUMP position	Above 2.7 MPa {Above 28 kg/cm ² }
	2	Malfunction of pump merge-divider solenoid valve	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.	
			Control levers	Solenoid output pressure
			All levers in NEUTRAL	0 MPa {0 kg/cm ² }
			Position for travel only (On either or both sides)	2.84 – 3.43 MPa {29 – 35 kg/cm ² }
	3	Malfunction of pump merge-divider valve	The pump merge-divider valve of the control valve may have a malfunction. Check it directly.	
	4	Malfunction of bucket control valve (spool)	The spool of the bucket control valve may have a malfunction. Check it directly.	
	5	Malfunction of bucket control valve (pressure compensation valve)	The pressure compensation valve of the bucket control valve may have a malfunction. Check it directly.	
	6	Malfunction or defective sealing of bucket control valve (safety-suction valves)	The safety-suction valves of the bucket control valve (on the bottom side and head side) may have a malfunction or their sealing may be defective. Check them directly.	
	7	Malfunction or defective sealing of centralized safety-suction valve	The centralized safety-suction valve of the control valve may have a malfunction or its sealing may be defective. Check it directly.	
	8	Bucket cylinder defective	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.	
			Bucket cylinder	Leakage from cylinder
			Relieved in CURL direction	20 cc/min

H-10 Work equipment does not move in its single operation

Trouble	<ul style="list-style-type: none"> Work equipment does not move in its single operation 	(1) The boom does not move when operated independently. (2) The arm does not move when operated independently. (3) The bucket does not move when operated independently.
Related information	<ul style="list-style-type: none"> Set the working mode at P mode for the troubleshooting. 	

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting	
	1	Malfunction of PPC valve	★ Stop engine for preparations. Start troubleshooting at engine high idle.	
			Work equipment control lever	PPC valve output pressure
			NEUTRAL	0 MPa {0 kg/cm ² }
			Operation	Above 2.7 MPa {Above 28 kg/cm ² }
	2	Malfunction of work equipment control valve (spool)	The spool in the work equipment control valve is presumed to malfunction. Check the valve itself.	

H-11 Hydraulic drift of work equipment is large

Trouble	• Hydraulic drift of work equipment is large.	(1) Hydraulic drift of boom is large.
Related information	• Conduct the troubleshooting in working mode P.	

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting	
	1	Boom cylinder defective	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.	
			Boom cylinder	Leakage from cylinder
			Relieved in RAISE direction	20 cc/min
	2	Defective sealing of boom control valve (lock valve)	Sealing of the lock valve of the boom control valve may be defective. Check it directly.	
	3	Defective sealing of centralized safety-suction valve	Sealing of the centralized safety-suction valve of the control valve may be defective. Check it directly.	

Trouble	• Hydraulic drift of work equipment is large.	(2) Hydraulic drift of arm is large.
Related information	• Conduct the troubleshooting in working mode P.	

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting	
	1	Arm cylinder defective	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.	
			Arm cylinder	Leakage from cylinder
			Relieved in IN direction	20 cc/min
	2	Defective sealing of arm control valve (spool)	Sealing of the spool of the arm control valve may be defective. Check it directly.	
	3	Defective sealing of arm control valve (suction valve)	Sealing of the suction valve of the arm control valve (on the bottom side) may be defective. Check it directly.	
	4	Defective sealing of arm control valve (lock valve) [When lock valve is installed]	Sealing of the lock valve of the arm control valve may be defective. Check it directly.	
	5	Defective sealing of centralized safety-suction valve	Sealing of the centralized safety-suction valve of the control valve may be defective. Check it directly.	

Trouble	• Hydraulic drift of work equipment is large.	(3) Hydraulic drift of bucket is large.
Related information	• Conduct the troubleshooting in working mode P.	

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting	
	1	Bucket cylinder defective	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.	
			Bucket cylinder	Leakage from cylinder
			Relieved in CURL direction	20 cc/min
	2	Defective sealing of bucket control valve (spool)	Sealing of the spool of the bucket control valve may be defective. Check it directly.	
	3	Defective sealing of bucket control valve (suction valve)	Sealing of the suction valve of the bucket control valve (on the bottom side) may be defective. Check it directly.	
	4	Defective sealing of centralized safety-suction valve	Sealing of the centralized safety-suction valve of the control valve may be defective. Check it directly.	

H-12 Time lag of work equipment is large

Trouble	• Time lag of work equipment is large.
Related information	• Conduct the troubleshooting in working mode P.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Malfunction of control valve (regeneration valve) [Only boom]	The regeneration valve of the control valve may have a malfunction. Check it directly.
	2	Malfunction of control valve (suction valve)	The suction valve of the control valve (on the head side) may have a malfunction. Check it directly.

H-13 One-touch power max system does not operate

Trouble	• One-touch power max system does not operate.
Related information	• Conduct the troubleshooting in working mode P.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting	
	1	Malfunction of 2-stage relief solenoid valve	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.	
			Swing lock switch	Solenoid output pressure
			OFF	0 MPa {0 kg/cm ² }
			ON	2.84 – 3.43 MPa {29 – 35 kg/cm ² }
	2	Malfunction of main relief valve	The main relief valve of the control valve may have a malfunction. Check it directly.	

H-14 Work equipment loaded more is slower during compound operation

Trouble	• Work equipment loaded more is slower during compound operation.
Related information	—

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Malfunction of pressure compensation valve of work equipment loaded less	The pressure compensation valve of the work equipment loaded less may have a malfunction. Check it directly.		
			Compound operation	More loaded side	Less loaded side
			Boom RAISE + Arm IN	Boom	Arm
			Boom RAISE + Arm OUT	Arm	Boom
			Boom RAISE + Bucket CURL	Boom	Bucket
			Arm IN + Bucket CURL	Arm	Bucket
			Boom LOWER + Arm OUT	Arm	Boom

H-15 Boom RAISE speed is low in compound operation of swing + boom RAISE

Trouble	• Boom RAISE speed is low in compound operation of swing + boom RAISE.
Related information	• If the speed of single operation of the boom RAISE speed is slow, conduct troubleshooting for H-7 first.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Malfunction or defective sealing of LS selector valve	
			The LS selector valve of the control valve may have a malfunction or its sealing may be defective. Check it directly.

H-16 Travel speed lowers largely during compound operation of work equipment/swing + travel

Trouble	• Travel speed lowers largely during compound operation of work equipment/swing + travel.		
Related information	• Conduct the troubleshooting in working mode P.		
Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Malfunction of pump merge-divider solenoid valve	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.
			Control levers
			All levers in NEUTRAL
			Position for travel only (On either or both sides)
	2	Malfunction of pump merge-divider valve	Solenoid output pressure
			0 MPa {0 kg/cm ² }
			2.84 – 3.43 MPa {29 – 35 kg/cm ² }
	3	Malfunction of work equipment control valve (pressure compensation valve)	The pressure compensation valve of the work equipment control valve may have a malfunction. Check it directly.
	4	Malfunction of swing control valve (pressure compensation valve)	The pressure compensation valve of the swing control valve may have a malfunction. Check it directly.
	5	Malfunction of travel control valve (pressure compensation valve)	The pressure compensation valve of the travel control valve may have a malfunction. Check it directly.

H-17 Machine deviates during travel

Trouble	• Machine deviates during travel.
Related information	• Conduct the troubleshooting in working mode P.

	Cause		Standard value in normal state/Remarks on troubleshooting		
Possible causes and standard value in normal state	1	Malfunction of self-pressure reducing valve	★	Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.	
			Control levers		Control circuit basic pressure
			All levers in NEUTRAL		2.84 – 3.43 MPa {29 – 35 kg/cm ² }
	2	Malfunction of travel PPC valve	★	Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.	
			Travel lever		PPC valve output pressure
			Forward or reverse position		Above 2.7 MPa {Above 28 kg/cm ² }
			Difference in above output between both sides		Below 0.4 MPa {Below 4 kg/cm ² }
	3	Malfunction of pump merge-divider valve	★	Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.	
			Travel lever		Solenoid valve output pressure
			All levers in NEUTRAL		0 MPa {0 kg/cm ² }
			Position for travel only (On either or both sides)		2.84 – 3.43 MPa {29 – 35 kg/cm ² }
	4	Malfunction of travel junction solenoid valve	★	Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.	
			Travel lever		Solenoid valve output pressure
			All levers in NEUTRAL		0 MPa {0 kg/cm ² }
			Position for travel only on either side		2.84 – 3.43 MPa {29 – 35 kg/cm ² }
	5	Malfunction of unload valve	★	Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.	
			Control levers	Hydraulic oil temperature	Unload pressure
			All levers in NEUTRAL	Approx. 50°C	Below 5.9 MPa {Below 60 kg/cm ² }
				Approx. 80°C	Below 7.4 MPa {Below 75 kg/cm ² }
	6	Malfunction of pump merge-divider valve	The pump merge-divider valve may have a malfunction. Check it directly.		
	7	Malfunction of travel junction valve	The travel junction valve may have a malfunction. Check it directly.		
	8	Malfunction of travel control lever (spool)	The spool of the travel control lever may have a malfunction. Check it directly.		
	9	Travel motor defective	★	Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.	
			Travel lever		Leakage from travel motor
			Travel circuit relieved		27.2 l/min
	10	Final drive defective	The final drive may have a defect in it. Check it directly. (It may be checked by abnormal sound, abnormal heating, metal chips in drain oil, etc.)		

H-18 Travel speed is low

Trouble	• Travel speed is low.		
Related information	• Conduct the troubleshooting in working mode P.		

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Malfunction of self-pressure reducing valve	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.		
			Control levers		Control circuit basic pressure
			All levers in NEUTRAL		2.84 – 3.43 MPa {29 – 35 kg/cm ² }
	2	Malfunction of travel PPC valve	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.		
			Travel lever		PPC valve output pressure
			Forward or reverse position		Above 2.7 MPa {Above 28 kg/cm ² }
			Difference in above output between both sides		Below 0.4 MPa {Below 4 kg/cm ² }
	3	Malfunction of pump merge-divider valve	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.		
			Travel lever		Solenoid valve output pressure
			All levers in NEUTRAL		0 MPa {0 kg/cm ² }
			Position for travel only (On either or both sides)		2.84 – 3.43 MPa {29 – 35 kg/cm ² }
	4	Malfunction of unload valve	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.		
			Control levers	Hydraulic oil temperature	Unload pressure
			All levers in NEUTRAL	Approx. 50°C	Below 5.9 MPa {Below 60 kg/cm ² }
				Approx. 80°C	Below 7.4 MPa {Below 75 kg/cm ² }
	5	Malfunction of pump merge-divider valve	The pump merge-divider valve may have a malfunction. Check it directly.		
	6	Malfunction of travel control lever (spool)	The spool of the travel control lever may have a malfunction. Check it directly.		
	7	Malfunction of travel control lever (pressure compensation valve)	The pressure compensation valve of the travel control lever may have a malfunction. Check it directly.		
	8	Malfunction of travel control lever (suction valve)	The suction valve of the travel control lever may have a malfunction. Check it directly.		
	9	Travel motor defective	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.		
			Travel lever		Leakage from travel motor
			Travel circuit relieved		27.2 ℓ/min
	10	Final drive defective	The final drive may have a defect in it. Check it directly. (It may be checked by abnormal sound, abnormal heating, metal chips in drain oil, etc.)		

H-19 Machine cannot be steered easily or steering power is low

Trouble	<ul style="list-style-type: none"> Machine cannot be steered easily or steering power is low.
Related information	<ul style="list-style-type: none"> Conduct the troubleshooting in working mode P.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting	
	1	Malfunction of travel PPC valve (steering spool)	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.	
			Travel lever	PPC valve output pressure (At starting switch)
			In NEUTRAL on both sides	0 MPa {0 kg/cm ² }
			Operated on either side	Above 2.7 MPa {Above 28 kg/cm ² }
	2	Malfunction of pump merge-divider valve	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.	
			Travel lever	Solenoid valve output pressure
			All levers in NEUTRAL	0 MPa {0 kg/cm ² }
			Position for travel only (On either or both sides)	2.84 – 3.43 MPa {29 – 35 kg/cm ² }
	3	Malfunction of travel junction solenoid valve	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.	
			Travel lever	Solenoid valve output pressure
			All levers in NEUTRAL	0 MPa {0 kg/cm ² }
			Position for travel only on either side	2.84 – 3.43 MPa {29 – 35 kg/cm ² }
	4	Malfunction of hydraulic pump (check valve)	The check valve of the hydraulic pump may have a malfunction or its sealing may be defective. Check it directly.	
	5	Malfunction of hydraulic pump (shuttle valve)	The shuttle valve of the hydraulic pump may have a malfunction or its sealing may be defective. Check it directly.	
	6	Malfunction of pump merge-divider valve	The pump merge-divider valve may have a malfunction. Check it directly.	
	7	Malfunction of travel junction valve	The travel junction valve may have a malfunction. Check it directly.	
	8	Malfunction of travel control lever (spool)	The spool of the travel control lever may have a malfunction. Check it directly.	
	9	Malfunction of travel control lever (pressure compensation valve)	The pressure compensation valve of the travel control lever may have a malfunction. Check it directly.	
	10	Malfunction of travel control lever (suction valve)	The suction valve of the travel control lever may have a malfunction. Check it directly.	
	11	Malfunction of travel motor (safety and check valve)	The safety and check valve of the travel motor may have a malfunction. Check it directly. (It may be checked by exchanging the front and rear motors or the right and left motors and checking change of the phenomenon.)	

H-20 Travel speed does not change or it is kept low or high

Trouble	• Travel speed does not change or it is kept low or high.
Related information	• Conduct the troubleshooting in working mode P.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Malfunction of travel speed selector solenoid valve	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.		
			Travel speed	Travel lever	Solenoid valve output pressure
			Lo	In NEUTRAL	0 MPa {0 kg/cm ² }
			Hi	Operated	2.84 – 3.43 MPa {29 – 35 kg/cm ² }
	2	Malfunction of travel motor (speed-changer unit)	The speed-changer unit of the travel motor may have a malfunction. Check it directly.		

H-21 Track does not move (Only either side)

Trouble	• Track does not move (only either side).
Related information	• Conduct the troubleshooting in working mode P.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting	
	1	Defective seat of travel control valve (suction valve)	The suction valve seat of the travel control lever may be defective. Check it directly.	
	2	Defective seat of travel control valve (safety and check valve)	The safety and check valve seat of the travel control lever may be defective. Check it directly.	
	3	Malfunction of travel motor (counterbalance valve)	The counterbalance valve of the travel motor may have a malfunction. Check it directly.	
	4	Travel motor defective	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.	
			Travel lever	Leakage from travel motor
			Travel circuit relieved	27.2 ℓ/min
	5	Final drive defective	The final drive may have a defect in it. Check it directly. (It may be checked by abnormal sound, abnormal heating, metal chips in drain oil, etc.)	

H-22 Machine does not swing

Trouble	• Machine does not swing.	(1) Machine does not swing in either direction.
Related information	• Conduct the troubleshooting in working mode P.	

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting	
	1	Malfunction of swing holding brake solenoid valve	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.	
			Right work equipment control lever	Solenoid valve output pressure
			In NEUTRAL	0 MPa {0 kg/cm ² }
			Operated for swing	2.84 – 3.43 MPa {29 – 35 kg/cm ² }
	2	Malfunction of swing motor (holding brake)	The holding brake of the swing motor may have a malfunction. Check it directly.	
	3	Swing motor defective	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.	
			Left work equipment control lever	Leakage from swing motor
			Swing circuit relieved	Below 10 ℓ/min
	4	Swing machinery defective	The swing machinery may have a defect in it. Check it directly. (It may be checked by abnormal sound, abnormal heating, metal chips in drain oil, etc.)	

Trouble	• Machine does not swing.	(2) Machine does not swing in only one direction.
Related information	• Conduct the troubleshooting in working mode P.	

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Malfunction of swing PPC valve	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.		
			Left work equipment control lever		PPC valve output pressure
			In NEUTRAL		0 MPa {0 kg/cm ² }
			Operated for swing		Above 2.7 MPa {Above 28 kg/cm ² }
	2	Malfunction of swing control valve (spool)	The spool of the swing control valve may have a malfunction. Check it directly.		
	3	Defective adjustment or malfunction of swing motor (safety valve)	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.		
			Swing lock switch	Left work equipment control lever	Swing relief pressure
			ON	Swing circuits relieved (separately on both sides)	28.9 – 32.9 MPa {295 – 335 kg/cm ² }
	4	Defective sealing of swing motor (suction valve)	Sealing of the suction valve of the swing motor may be defective. Check it directly.		

H-23 Swing acceleration or swing speed is low

Trouble	• Swing acceleration or swing speed is low.	(1) Swing acceleration or swing speed is low in both directions.
Related information	• Conduct the troubleshooting in working mode P.	

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting	
	1	Malfunction of swing control valve (pressure compensation valve)	The pressure compensation valve of the swing control valve may have a malfunction. Check it directly.	
	2	Malfunction of swing motor (holding brake)	The holding brake of the swing motor may have a malfunction. Check it directly.	
	3	Swing motor defective	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.	
			Left work equipment control lever	Leakage from swing motor
			Swing circuit relieved	Below 10 ℓ/min
	4	Swing machinery defective	The swing machinery may have a defect in it. Check it directly. (It may be checked by abnormal sound, abnormal heating, metal chips in drain oil, etc.)	

Trouble	• Swing acceleration or swing speed is low.	(2) Swing acceleration or swing speed is low in only one direction.
Related information	• Conduct the troubleshooting in working mode P.	

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Malfunction of swing PPC valve	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.		
			Left work equipment control lever		PPC valve output pressure
			In NEUTRAL		0 MPa {0 kg/cm ² }
			Operated for swing		Above 2.7 MPa {Above 28 kg/cm ² }
	2	Malfunction of swing control valve (spool)	The spool of the swing control valve may have a malfunction. Check it directly.		
	3	Defective adjustment or malfunction of swing motor (safety valve)	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.		
			Swing lock switch	Left work equipment control lever	Swing relief pressure
			ON	Swing circuits relieved (separately on both sides)	28.9 – 32.9 MPa {295 – 335 kg/cm ² }
	4	Defective sealing of swing motor (suction valve)	Sealing of the suction valve of the swing motor may be defective. Check it directly.		

H-24 Excessive overrun when stopping swing

Trouble	• Excessive overrun when stopping swing.	(1) Overrun of upper structure is large in both directions.
Related information	• Conduct the troubleshooting in working mode P.	

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting	
	1	Swing motor defective	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.	
			Left work equipment control lever	Leakage from swing motor
			Swing circuit relieved	Below 10 ℓ/min

Trouble	• Excessive overrun when stopping swing.	(2) Overrun of upper structure is large in only one direction.
Related information	• Conduct the troubleshooting in working mode P.	

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Malfunction of swing PPC valve	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.		
			Left work equipment control lever		PPC valve output pressure
			In NEUTRAL		0 MPa {0 kg/cm ² }
			Operated for swing		Above 2.7 MPa {Above 28 kg/cm ² }
	2	Clogging of swing PPC slow return valves	The swing PPC slow return valves may be clogged. Check them directly. (They may be checked by exchanging with each other and checking change of the phenomenon.)		
	3	Malfunction of swing control valve (spool)	The spool of the swing control valve may have a malfunction. Check it directly.		
	4	Defective adjustment or malfunction of swing motor (safety valve)	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.		
			Swing lock switch	Left work equipment control lever	Swing relief pressure
			ON	Swing circuits relieved (separately on both sides)	28.9 – 32.9 MPa {295 – 335 kg/cm ² }
	5	Defective sealing of swing motor (suction valve)	Sealing of the suction valve of the swing motor may be defective. Check it directly.		

H-25 When upper structure stops swinging, it makes large shock

Trouble	• When upper structure stops swinging, it makes large shock.
Related information	• Conduct the troubleshooting in working mode P.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting	
	1	Malfunction of swing PPC valve	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.	
			Left work equipment control lever	PPC valve output pressure
			In NEUTRAL	0 MPa {0 kg/cm ² }
			Operated for swing	Above 2.7 MPa {Above 28 kg/cm ² }
	2	Malfunction of swing PPC slow return valves	The swing PPC slow return valves may have a malfunction. Check them directly. (They may be checked by exchanging with each other and checking change of the phenomenon.)	
	3	Malfunction of swing motor (shockless valve)	The shockless valve of the swing motor may have malfunction. Check it directly.	

H-26 When upper structure stops swinging, it makes loud sound

Trouble	• When upper structure stops swinging, it makes large sound.
Related information	• Conduct the troubleshooting in working mode P.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting
	1	Malfunction of back pressure check valve	The back pressure check valve may have a malfunction. Check it directly.
	2	Malfunction of swing motor (safety valve)	The swing motor (safety valves) may have a malfunction. Check the valves directly. (They may be checked by exchanging with each other and checking change of the phenomenon.)
	3	Malfunction of swing motor (suction valves)	The swing motor (suction valves) may have a malfunction. Check the valves directly. (They may be checked by exchanging with each other and checking change of the phenomenon.)
	4	Swing machinery defective	The swing machinery may have a defect in it. Check it directly. (It may be checked by abnormal sound, abnormal heating, metal chips in drain oil, etc.)

H-27 Hydraulic drift of swing is large

Trouble	<ul style="list-style-type: none"> Hydraulic drift of swing is large. 	(1) When swing holding brake is operated
Related information	<ul style="list-style-type: none"> If the swing lock switch is turned ON or the swing holding brake release switch is in the normal position, the swing brake operates and the disc brake holds the upper structure. Conduct the troubleshooting in working mode P. 	

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting	
	1	Malfunction of swing holding brake solenoid valve	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.	
			Right work equipment control lever	Solenoid valve output pressure
			In NEUTRAL	0 MPa {0 kg/cm ² }
			Operated for swing	2.84 – 3.43 MPa {29 – 35 kg/cm ² }
	2	Malfunction or internal defect of swing motor (holding brake)	The holding brake of the swing motor may have a malfunction or an internal defect. Check it directly.	

Trouble	<ul style="list-style-type: none"> Hydraulic drift of swing is large. 	(2) When swing holding brake is released
Related information	<ul style="list-style-type: none"> If the swing holding brake release is in the emergency position, the swing holding brake is released and the upper structure is held with only hydraulic pressure. Conduct the troubleshooting in working mode P. 	

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting	
	1	Defective sealing of swing control valve (spool)	Sealing of the spool of the swing control valve may have a malfunction. Check it directly.	
	2	Defective sealing of swing motor (safety valve)	The safety valves of the swing motor may have a malfunction. Check them directly. (They may be checked by exchanging with each other and checking change of the phenomenon.)	
	3	Defective sealing of swing motor (suction valve)	The suction valves of the swing motor may have a malfunction. Check them directly. (They may be checked by exchanging with each other and checking change of the phenomenon.)	
	4	Malfunction or defective sealing of swing motor (shockless valve)	The shockless valve of the swing motor may have a malfunction or its sealing may be defective. Check it directly.	

H-28 Attachment circuit does not change

When attachment is installed

Trouble	<ul style="list-style-type: none"> The return circuit of the attachment circuit does not change.
Related information	<ul style="list-style-type: none"> If an attachment is installed, the service circuit changes according to the selected working mode as shown below. <ol style="list-style-type: none"> In mode P or E: The double acting circuit is selected and the safety valve is set to the low pressure. In mode B: The single acting circuit is selected and the safety valve is set to the high pressure. * Setting of the safety valve on only port B side is changed. Port A is always set to the low pressure.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting	
	1	Malfunction of attachment return selector solenoid valve	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.	
			Working mode	Solenoid valve output pressure
			Mode E or P	0 MPa {0 kg/cm ² }
			Mode B	2.84 – 3.43 MPa {29 – 35 kg/cm ² }
	2	Malfunction of attachment return selector valve	The attachment return selector valve may have a malfunction. Check it directly.	
	3	Malfunction of service control valve (safety valve)	The safety valve of the service control valve (on port B side) may have a malfunction. Check it directly.	

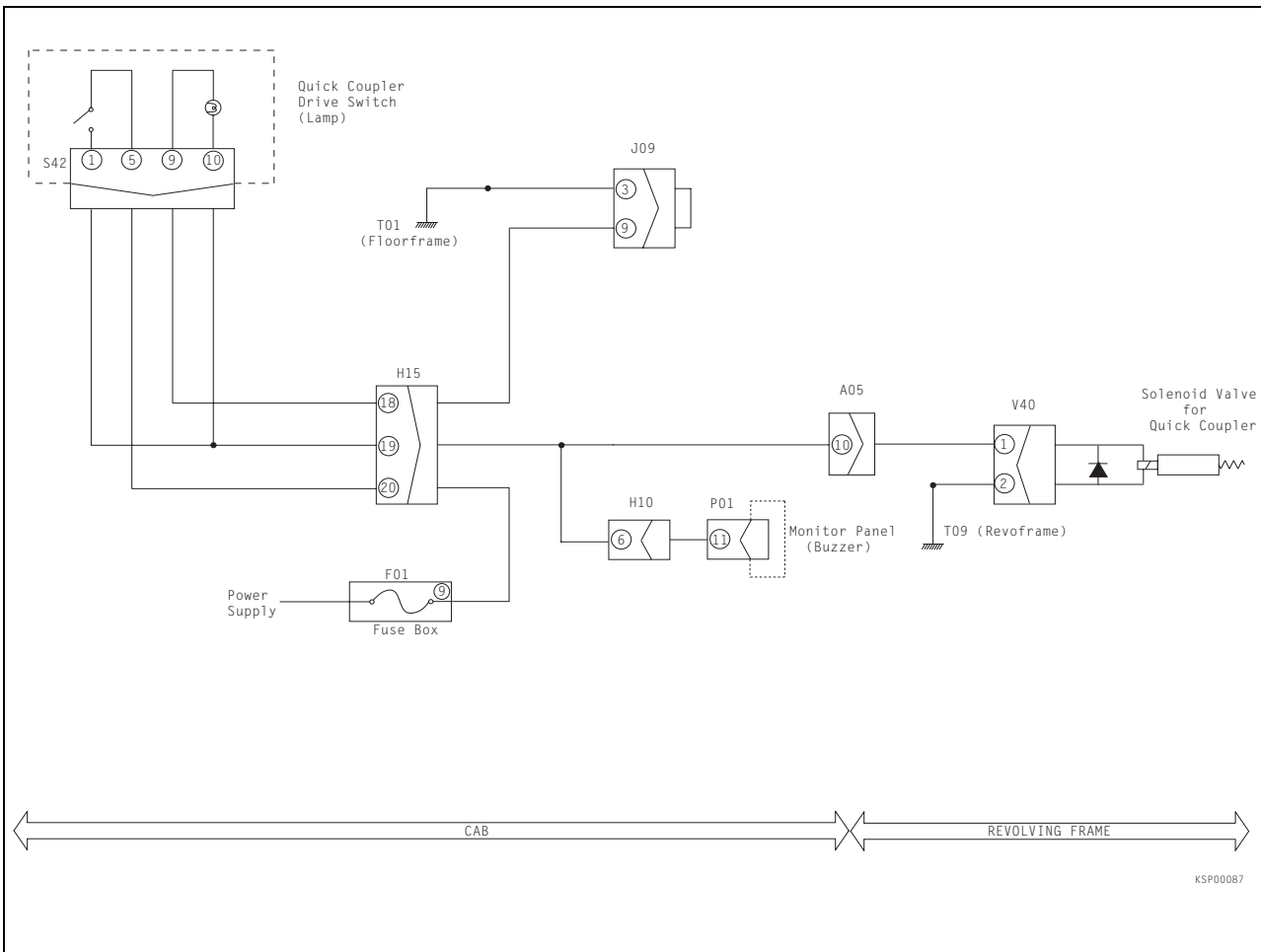
H-29 Flow rate in attachment circuit cannot be adjusted

When attachment is installed

Trouble	<ul style="list-style-type: none"> Flow rate in attachment circuit cannot be adjusted.
Related information	<ul style="list-style-type: none"> If an attachment is installed, the flow rate in the service circuit changes according to the selected working mode. How to adjust the flow rate in modes P and E is different from that in mode B. For details, see Operation manual.

Possible causes and standard value in normal state	Cause		Standard value in normal state/Remarks on troubleshooting		
	1	Malfunction of attachment flow rate adjustment EPC valve	The attachment flow rate adjustment EPC valve may have a malfunction. Check it directly.		
	2	Malfunction of service PPC valve	★ Keep the engine stopped for the preparations, and keep it running at high idle during the troubleshooting.		
			Wiring harness connector	Service pedal	PPC valve output pressure
			Disconnect connector V30 of attachment flow rate adjustment EPC valve.	In NEUTRAL	0 MPa {0 kg/cm ² }
				Operated	Above 2.7 MPa {Above 28 kg/cm ² }

Quick coupler



Trouble	(1) Quick coupler cylinder will not extend		
Related information	Quick coupler block assembly has 2 cartridge valves in it, a 3 port pressure reducer to regulate the pressure to both the solenoid valve and quick coupler cylinder and a 4/2 solenoid operated directional control valve, this functions as follows: -Default position allows oil to flow to extend quick coupler cylinder [lock].		
Possible causes and standard value in normal state	Cause		Remarks on troubleshooting
	1	Pressure setting too low for particular quick coupler	If there is insufficient pressure achieved at the quick coupler cylinder, then it won't move. Adjust pressure according to quick coupler specification (refer to Testing and Adjusting Section 30 for measuring and adjustment procedure)
	2	Power supply to solenoid coil not removed	This will result in solenoid coil being energised and oil being directed to retract the quick coupler cylinder
			★ Prepare with starting switch OFF, then turn starting switch ON (but quick coupler switch OFF) and carry out troubleshooting.
			V40 (female) between (1) - (2). Voltage below 1V.
	3	Directional control valve malfunction	Directional control valve may have a malfunction (eg. sticking spool). Check it directly and replace complete directional control valve if necessary.
	4	Malfunction of pressure reducer	This may result in insufficient pressure being available. Measure pressure as explained in "Testing and Adjusting Section 30" then check if pressure can be adjusted, if it can't replace complete pressure reducer.

Trouble	(2) Quick coupler cylinder will not extend (but buzzer does not sound)		
Related information	Quick coupler block assembly has 2 cartridge valves in it, a 3 port pressure reducer to regulate the pressure to the both the solenoid valve and quick coupler cylinder and a 4/2 solenoid operated directional control valve, this functions as follows: -When operation switch in operators cab is in "ON" position solenoid is energised switching valve which allows oil to flow to retract quick coupler cylinder [UNLOCK]. At the same time a warning buzzer sounds and the lamp on the switch comes on.		
Possible causes and standard value in normal state	Cause		Remarks on troubleshooting
	1	Defective solenoid coil	Valve will not switch
			★ Prepare with starting switch OFF then carry out troubleshooting.
			V40 (male) between (1) and (2) resistance 30+/-1.5Ω
			V40 (male) between (1) (+ positive) and chassis ground resistance Min 1MΩ
	2	No power supply to solenoid coil	Valve will not switch
			★ Prepare with starting switch OFF, then turn starting switch ON and quick coupler switch ON and carry out troubleshooting
			V40 (female) between (1) - (2). Voltage 20-30 V.
	3	Ground fault in wiring harness (short circuit with GND circuit)	★ Prepare with starting switch OFF, then carry out troubleshooting.
			V40 (female) (1) - Ground resistance above 1MΩ
	4	Directional control valve malfunction	Directional control valve may have a malfunction (eg sticking spool). Check it directly and replace the complete directional control valve if necessary.
	5	Malfunction of pressure reducer	This may result in insufficient pressure being available. Measure pressure as explained in "Testing and Adjusting Section 30" then check if pressure can be adjusted, if it can't replace complete pressure reducer.
	6	Pilot operated check in quick coupler falling to operate	Consult specific quick coupler manufacturer for the specification.

Trouble	(3) Buzzer does not sound (but quick coupler cylinder does retract)		
Related information	When operation switch in operators cab is in "ON" position a buzzer sounds and light on the switch comes on to warn the operator.		
Possible causes and standard value in normal state	Cause		Remarks on troubleshooting
	1	No power supply to Monitor Panel (buzzer)	★ Prepare with starting switch OFF then carry out troubleshooting
			H15 (female) (19) - P01 (female) (11) resistance below 1Ω
	2	Monitor Panel (buzzer) malfunction	If (1) above is OK then replace Monitor Panel.

Trouble	(4) Quick coupler cylinder extends and retracts slowly		
Possible causes and standard value in normal state	Cause		Remarks on troubleshooting
	1	Restriction in tank line	Check that hose isn't crushed or kinked.
	2	Hydraulic system pressure too low	Depending on the design of the quick coupler it may be necessary to operate the swing lever to raise the pressure in the hydraulic system.

PC160LC-7E0, PC180LC/NLC-7E0 Hydraulic excavator

Form No. UEN02118-01

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Printed in Belgium 09-07 (02)

HYDRAULIC EXCAVATOR

PC160LC-7E0

PC180LC-7E0

PC180NLC-7E0

Machine model Serial number

PC160LC-7E0	K45001 and up
PC180LC-7E0	K45001 and up
PC180NLC-7E0	K45001 and up

40 Troubleshooting

Troubleshooting of engine (S-mode)

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Method of using troubleshooting chart

The troubleshooting chart consists of the "questions", "check items", "causes", and "troubleshooting" blocks. The questions and check items are used to pinpoint high probability causes by simple inspection or from phenomena without using troubleshooting tools.

Next, troubleshooting tools or direct inspection are applied to check the narrowed causes in order from the most probable one to make final confirmation according to the troubleshooting procedure.

Questions

Items to be drawn from the user or operator. They correspond to **A** and **B** in the chart on the right. The items in **A** are basic ones. The items in **B** can be drawn from the user or operator, depending on their level.

Check items

Simple check items used by the serviceman to narrow the causes. They correspond to **C** in the chart on the right.

Causes

Items to be narrowed from the questions and check items. The serviceman narrows down the probable causes from **A**, **B**, and **C**.

Troubleshooting

Items used to find out the true cause by verifying the narrowed causes finally in order from the most probable one by applying troubleshooting tools or direct inspection.

Items listed in the [Questions] and [Check items] and related to the [Causes] are marked with \triangle , \circ , and \odot .

\triangle : Causes to be referred to for questions and check items

\circ : Causes related to questions and check items

\odot : Causes highly probable among ones marked with \circ

★ When narrowing the "causes", apply the items marked with \odot before those marked with \circ .

When narrowing the causes, do not apply the items marked with \triangle . (If no items have other marks and the causes cannot be narrowed, however, you may apply them.)

		Causes			
		1	2	3	4
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		11	\odot		
Troubleshooting	a		●		
	b			●	
	c				●
	d				●

BJE10168

Let us assume that a trouble of "Exhaust gas is black" occurred and we checked the [Questions] and [Check items] and found the following 3 items to be the causal symptoms; [Exhaust gas slowly became black], [Power slowly became weaker], and [Dust indicator is lighting red].

General causes why exhaust smoke is black

- Insufficient intake of air
- Defective condition of fuel injection
- Improper selection of fuel
- There is overheating
→ See "S-14 Coolant temperature becomes too high (Overheating)"
- Controller is controlling in derate mode (limiting injection rate (output) because of an error in electrical system)

Exhaust smoke is black (incomplete combustion)

General causes why exhaust smoke is black

- Insufficient intake of air
- Defective condition of fuel injection
- Improper selection of fuel
- There is overheating
→See"S-14 Coolant temperature becomes too high (Overheating)"
- Controller is controlling in derate mode(limiting injection rate (output))because of an error in electrical system

Causes

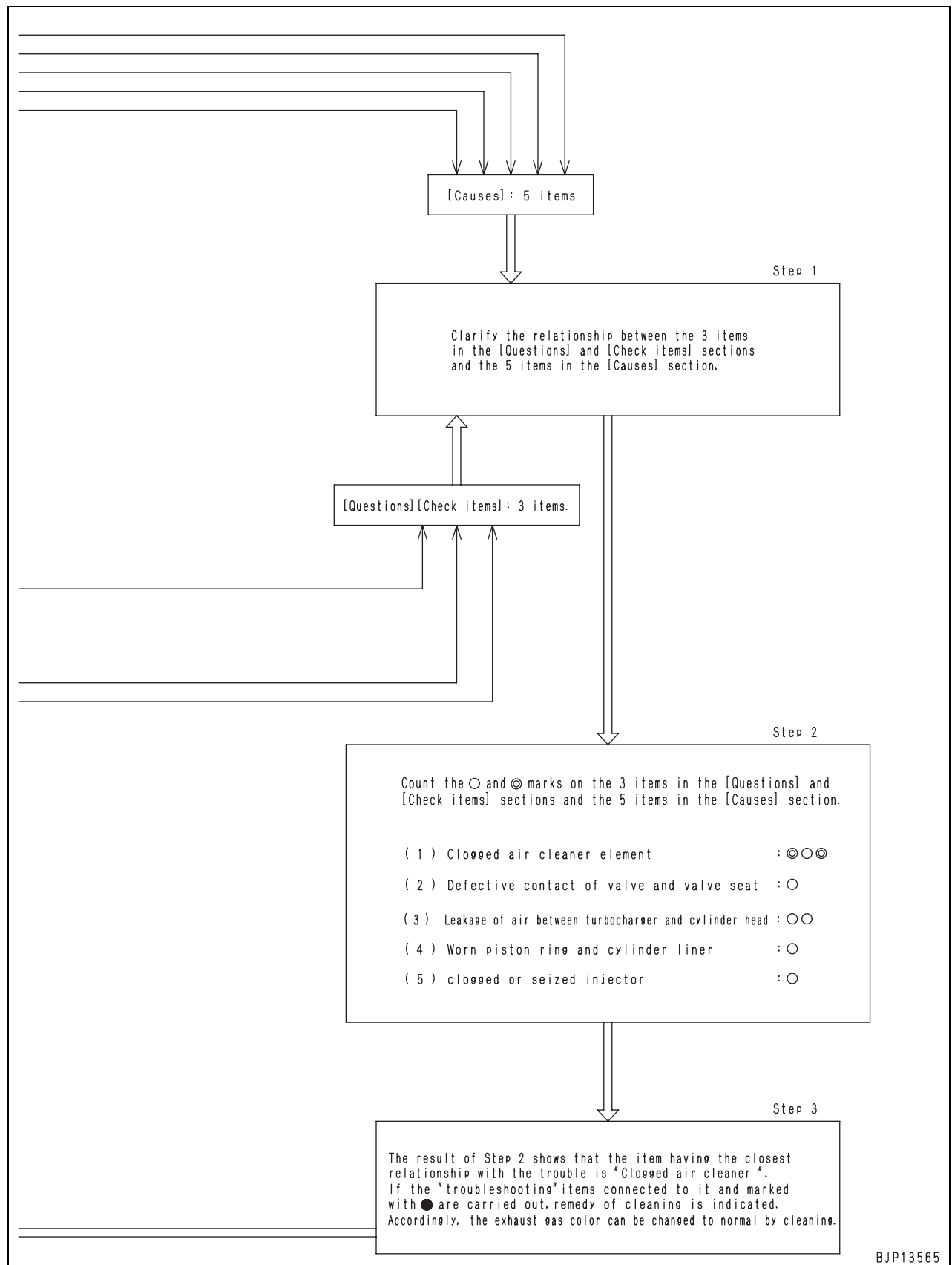
Closed air cleaner element	Seized turbocharger, interference of turbocharger	Defective contact of valve and valve seat	Improper valve clearance	Leakage of air between turbocharger and cylinder head	Crushed, clogged muffler	Worn piston ring, cylinder liner	Stuck, seized supply pump plunger	Clogged, seized injector	Abnormally worn injector	Improper fuel injection timing	Improper fuel injection pressure	Defective coolant temperature sensor, wiring harness
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Questions			Closed air cleaner element	Seized turbocharger, interference of turbocharger	Defective contact of valve and valve seat	Improper valve clearance	Leakage of air between turbocharger and cylinder head	Crushed, clogged muffler	Worn piston ring, cylinder liner	Stuck, seized supply pump plunger	Clogged, seized injector	Abnormally worn injector	Improper fuel injection timing	Improper fuel injection pressure	Defective coolant temperature sensor, wiring harness
Check items	Confirm recent repair history														
	Degree of use of machine	Operated for long period	△	△					△						
	Color of exhaust gas	Suddenly became black	◎			◎				○	○	○			
		Gradually became black	◎			○				○					
		Blue under light load						◎							
	Non-specified fuel is being used														
	Oil must be added more frequently							◎		○					
	Power was lost	Suddenly		◎			○		○	○					
		Gradually	○	○		○		○							
	Dust indicator is red		◎												
	Muffler is crushed						◎								
	Air leaks between turbocharger and cylinder head, clamp is loosened					◎									
Check items	Engine is operated in low-temperature mode at normal temperature												○	○	○
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low									○	◎				
	When engine is cranked, interference sound is generated around turbocharger			◎											
	When engine is cranked, abnormal sound is generated around cylinder head				◎										
	Pump relief speed is high (Fuel is injected excessively)											○			
	Exhaust noise is abnormal			○			◎			○					
	Engine dose not pick up smoothly and combustion is irregular			○	○	○	○		○	◎					
	Blow-by gas is excessive							◎							
	If spill hose from injector is disconnected, abnormally much fuel spills										◎				
Troubleshooting	Inspect air cleaner directly		●												
	When turbocharger is rotated by hand, it is found to be heavy			●											
	When compression pressure is measured, it is found to be low				●				●						
	Inspect valve clearance directly					●									
	When muffler is removed, exhaust sound improves						●								
	Carry out troubleshooting according to"Rail Press (Very) Low Error (#1)" indicated by code									●		●			
	When a cylinder is cut out for reduced cylinder mode operation, engine speed dose not change										●				
	Carry out troubleshooting according to"Coolant temp Sens High (Low) Error (#2)" indicated by code											●			
	Check with monitoring function												●	●	●
Remedy			Clean	Replace	Replace	Adjust	Correct	Replace	Replace	Replace	Replace	Replace	Adjust	Replace	Replace

BJP13564

There is a causal relationship between 3 items in the [Questions] and [Check items] sections and 5 items in the [Causes] section.

The method of pinpointing the "cause" from the causal relationship and approaching the "troubleshooting" is explained according to Step 1 – Step 3 shown below.



BJP13565

S-1 Starting performance is poor

General causes why starting performance is poor

- Defective electrical system
- Insufficient supply of fuel
- Insufficient intake of air
- Improper selection of fuel
- ★ The common rail fuel injection system (CRI) recognizes the fuel injection timing electrically. Accordingly, even if the starting operation is carried out, the engine may not start until the crankshaft revolves 2 turns at maximum. This phenomenon does not indicate a trouble, however.

		Causes										
		Clogged air cleaner element	Defective contact of valve, valve seat	Worn piston ring, cylinder	Clogged air breather hole of fuel tank cap	Leaking or clogged fuel piping, entry of air	Clogged fuel filter, element	Stuck, seized supply pump plunger	Defective injector	Defective intake air heater system	Defective alternator (regulator section)	Defective alternator (generator section)
Questions	Confirm recent repair history											
	Degree of use of machine	Operated for long period	△				△					△
	Starting performance	Became worse gradually	○	○			○					
		Engine starts easily when warm								○		○
	Non-specified fuel is being used						○	○	○			
	Replacement of filters has not been carried out according to Operation and Maintenance Manual		○				○	○	○			
	Engine oil must be added more frequently			○								
	When engine is preheated or when temperature is low, preheating monitor does not indicate normally								○			
	During operation, charge level monitor indicates abnormal charge										○	○
	Dust indicator is red		○									
Check items	Air breather hole of fuel tank cap is clogged				○							
	Fuel is leaking from fuel piping					○	○					
	When priming pump is operated, it makes no reaction or it is heavy					○	○					
	Starting motor cranks engine slowly											○
	While engine is cranked with starting motor	If air bleeding plug of fuel filter is removed, fuel does not flow out					○					
		If spill hose from injector is disconnected, little fuel spills						○				
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low								○			
	Engine does not pick up smoothly and combustion is irregular			○	○				○			
	There is hunting from engine (rotation is irregular)				○	○	○					
	Blow-by gas is excessive			○								

Troubleshooting	Inspect air cleaner directly		●													
	When compression pressure is measured, it is found to be low			●	●											
	When air is bled from fuel system, air comes out						●									
	Inspect fuel filter, element directly							●								
	Carry out troubleshooting according to "Rail Press (Very) Low Error (*1)" indicated by code								●							
	When a cylinder is cut out for reduced cylinder mode operation, engine speed does not change									●						
	When starting switch is turned to HEAT, intake air heater mount does not become warm										●					
	Is voltage 20 – 30 V between alternator terminal B and terminal E with engine at low idle?	Yes										●				
		No												●		
	When specific gravity of electrolyte and voltage of battery are measured, they are low															●
		Remedy	Clean	Replace	Replace	Clean	correct	Clean	Replace	Replace	Replace	Adjust	Replace	Replace		

*1: Displayed failure codes [CA559] and [CA2249]

S-2 Engine does not start

a) Engine does not turn

General causes why engine does not turn

- Internal parts of engine seized
→ See "S-4 Engine stops during operations"
- Defective electrical system
- Defective electrical system (Starting circuit)

			Causes							
			Broken flywheel ring gear	Defective or deteriorated battery	Defective connection of battery terminal	Defective battery relay	Defective starting switch	Defective safety relay	Defective starting motor (motor section)	Defective starting circuit wiring
Questions	Confirm recent repair history									
	Degree of use of machine	Operated for long period	△	△						
	Condition of horn when starting switch is turned ON	Horn does not sound			○		○			○
		Horn volume is low		○						
Check items	Battery electrolyte is low			○						
	Battery terminal is loose				○					
	When starting switch is turned ON, there is no operating sound from battery relay			○		○				
	When starting switch is turned to START, starting pinion does not move out			○			○			○
	When starting switch is turned to START, starting pinion moves out, but	Speed of rotation is low		○						
		Makes grating noise	○						○	
		Soon disengages again						○		
		Makes rattling noise and does not turn		○				○	○	

Troubleshooting	Inspect flywheel ring gear directly		●							Carry out troubleshooting in E-mode
	When specific gravity of electrolyte and voltage of battery are measured, they are low			●						
	Turn starting switch OFF, connect cord, and carry out troubleshooting at ON	There is not voltage (20 – 30 V) between battery relay terminal B and terminal E				●				
		When terminal B and terminal C of starting switch are connected, engine starts					●			
		When terminal B and terminal C at safety relay outlet are connected, engine starts						●		
		Even if terminal B and terminal C at safety relay outlet are connected, engine does not start							●	
		When safety switch terminal and terminal B of starting motor are connected, engine starts							●	
	Remedy	Replace	Replace	Correct	Replace	Replace	Replace	Replace	—	

b) Engine turns but no exhaust smoke comes out

General causes why engine turns but no exhaust smoke comes out

- Fuel is not being supplied
- Supply of fuel is extremely small
- Improper selection of fuel (particularly in winter)

b) Engine turns but no exhaust smoke comes out			Causes											
			Use of improper fuel	Insufficient fuel in tank	Clogged air breather hole of fuel tank cap	Leaking or clogged fuel piping, entry of air	Clogged fuel filter element	Seized, abnormally worn feed pump	Broken supply pump shaft	Stuck, seized supply pump plunger	Defective supply pump MPROP	Defective operation of overflow valve (Does not close)	Defective common rail pressure limiter	Defective fuel injector
General causes why engine turns but no exhaust smoke comes out			<div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div> <div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div> <div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div> <div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div> <div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div> 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*1: Displayed failure codes [CA559] and [CA2249]

*2: Displayed failure codes [CA271] and [CA272]

c) Exhaust smoke comes but engine does not start (fuel is being injected)

General causes why exhaust smoke comes out but engine does not start

- Lack of rotating force due to defective electrical system
- Insufficient supply of fuel
- Insufficient intake of air
- Improper selection of fuel

c) Exhaust smoke comes but engine does not start (fuel is being injected)			Causes											
			Clogged air cleaner element	Worn dynamic valve system (Valve, rocker lever, etc.)	Worn piston ring, cylinder liner	Use of improper fuel	Clogged air breather hole of fuel tank cap	Leaking or clogged fuel system, entry of air	Clogged fuel filter	Stuck, seized supply pump plunger	Clogged injector, defective spray	Defective, deteriorated battery	Defective coolant temperature sensor, wiring harness	Defective intake air heater system
General causes why exhaust smoke comes out but engine does not start														
			<ul style="list-style-type: none">• Lack of rotating force due to defective electrical system• Insufficient supply of fuel• Insufficient intake of air• Improper selection of fuel											
Questions	Confirm recent repair history													
	Degree of use of machine	Operated for long period			△				△		△			
	Suddenly failed to start			○						○			○	
	Non-specified fuel is being used									○	○			
	Replacement of filters has not been carried out according to Operation and Maintenance Manual			○						○				
	Engine oil must be added more frequently				○									
	When engine is preheated or when temperature is low, preheating monitor does not indicate normally													○
	Dust indicator is red			○										
	Air breather hole of fuel tank cap is clogged						○							
	Rust and water are found when fuel tank is drained								○					
	When fuel filter is removed, there is not fuel in it					○								
	Fuel is leaking from fuel piping								○					
	When priming pump is operated, it makes no reaction or it is heavy								○	○				
	Starting motor cranks engine slowly												○	
Check items	When engine is cranked, abnormal sound is generated around cylinder head			○										
	While engine is cranked with starting motor,	If air bleeding plug of fuel filter is removed, fuel does not flow out				○				○				
		If spill hose from injector is disconnected, little fuel spills								○				
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low											○		
Troubleshooting	Inspect air cleaner directly			●										
	Inspect dynamic valve system directly				●									
	When compression pressure is measured, it is found to be low					●								
	When air is bled from fuel system, air comes out							●						
	Inspect fuel filter directly								●					
	Carry out troubleshooting according to "Rail Press (Very) Low Error (*1)" indicated by code									●				
	Engine can be started in reduced cylinder mode.										●			
	When specific gravity of electrolyte and voltage of battery are measured, they are low											●		
	Coolant temperature gauge does not indicate normally												●	
	When starting switch is turned to HEAT, intake air heater mount does not become warm													●
		Remedy	Clean	Replace	Replace	Replace	Clean	Correct	Clean	Replace	Replace	Replace	Replace	Replace

*1: Displayed failure codes [CA559] and [CA2249]

S-3 Engine does not pick up smoothly

General causes why engine does not pick up smoothly

- Insufficient intake of air
- Insufficient supply of fuel
- Defective condition of fuel spray
- Improper selection of fuel
- Controller is controlling in derate mode (limiting injection rate (output) because of an error in electrical system)

		Causes									
		Clogged air cleaner element	Defective contact of valve and valve seat	Improper valve clearance	Seized turbocharger, interference of turbocharger	Worn piston ring, cylinder liner	Clogged air breather hole of fuel tank cap	Leaking or clogged fuel piping, entry of air	Clogged fuel filter	Stuck, seized supply pump plunger	Clogged injector, defective spray
Questions	Confirm recent repair history										
	Degree of use of machine	Operated for long period	△	△		△			△		
	Engine pick-up suddenly became worse				○		○	○			○
	Non-specified fuel is being used								○	○	○
	Replacement of filters has not been carried out according to Operation and Maintenance Manual	○							○		
	Oil must be added more frequently					○					
	Dust indicator is red	○									
	Air breather hole of fuel tank cap is clogged						○				
	Rust and water are found when fuel tank is drained								○		
	Fuel is leaking from fuel piping							○			
	When priming pump is operated, it makes no reaction or it is heavy							○	○		
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low									○	○
	Colour of exhaust gas	Blue under light load				○					
		Black	○	○		○					○
Check items	When engine is cranked, abnormal sound is generated around cylinder head			○							
	When engine is cranked, interference sound is generated around turbocharger				○						
	High idle speed under no load is normal, but speed suddenly drops when load is applied						○		○		
	There is hunting from engine (rotation is irregular)						○		○		○
	Blow-by gas is excessive					○					
Troubleshooting	Inspect air cleaner directly	●									
	When compression pressure is measured, it is found to be low		●			●					
	Inspect valve clearance directly			●							
	When turbocharger is rotated by hand, it is found to be heavy				●						
	When air is bled from fuel system, air comes out							●			
	Inspect fuel filter, strainer directly								●		
	Carry out troubleshooting according to "Rail Press (Very) Low Error (*1)" indicated by code									●	
	When a cylinder is cut out for reduced cylinder mode operation, engine speed does not change										●
Remedy		Clean	Replace	Adjust	Replace	Replace	Clean	Correct	Clean	Replace	Replace

*1: Displayed failure codes [CA559] and [CA2249]

S-4 Engine stops during operations

General causes why engine stops during operations

- Seized parts inside engine
- Insufficient supply of fuel
- There is overheating
- Defective hydraulic pump

General causes why engine stops during operations		Causes															
		Broken dynamic valve system (valve, rocker arm, etc.)	Broken, seized piston, connecting rod	Broken, seized crankshaft bearing	Broken, seized gear train	Insufficient fuel in tank	Clogged air breather hole of fuel tank cap	Leaking, clogged fuel piping	Clogged fuel filter	Broken, seized feed pump	Broken supply pump shaft	Stuck, seized supply pump plunger	Broken auxiliary equipment (pump, compressor, etc.)	Defective hydraulic pump	Defective engine controller power supply wiring	Defective starting switch wiring	
Questions	Confirm recent repair history																
	Degree of use of machine	Operated for long period							△								
	Condition when engine stopped	Abnormal noise was heard and engine stopped suddenly	○	○	○	○				○	○	○	○	○	○		
		Engine overheated and stopped		○	○									○			
		Engine stopped slowly					○			○						○	○
		There was hunting and engine stopped					○	○		○	○					○	○
	Non-specified fuel is being used									○	○		○				
	Replacement of filters has not been carried out according to Operation and Maintenance Manual									○							
	Fuel level monitor indicates low level (if monitor is installed)						○										
	When fuel tank is inspected, it is found to be empty						○										
Check items	Air breather hole of fuel tank cap is clogged							○									
	Fuel is leaking from fuel piping								○								
	When priming pump is operated, it makes no reaction or it is heavy								○	○							
	Rust and water are found when fuel tank is drained									○							
	Metal particles are found when oil is drained		○	○	○						○						
	When engine is cranked by hand	Does not turn at all		○	○												
		Turns in opposite direction	○														
		Moves by amount of gear backlash				○								○			
		Supply pump shaft does not turn										○					
	Engine turns, but stops when load is applied to machine														○		

Troubleshooting	Inspect dynamic valve system directly	●												Carry out troubleshooting in H-mode				
	Inspect piston, connecting rod directly		●															
	Inspect crankshaft bearing directly			●														
	Inspect gear train directly				●													
	Inspect fuel filter, strainer directly								●									
	Inspect feed pump directly									●								
	Carry out troubleshooting according to "Rail Press (Very) Low Error (*1)" indicated by code										●	●						
	Engine rotates when pump auxiliary equipment (pump, compressor, etc.) is removed												●					
	Inspect controller power supply wiring															●		
	Inspect starting switch wiring																●	
		Remedy	Replace	Replace	Replace	Replace	Add	Clean	Correct	Clean	Replace	Replace	Replace		Replace	—	—	—

*1: Displayed failure codes [CA559] and [CA2249]

S-5 Engine does not rotate smoothly

General causes why engine does not rotate smoothly

- Air in fuel system
- Defective speed sensor (Error at degree that it is not indicated)

		Causes						
		Insufficient fuel in tank	Clogged air breather hole of fuel tank cap	Leaking or clogged fuel piping, entry of air	Clogged fuel filter	Clogged injector, defective spray (dirt in injector)	Defective Ne speed sensor, wiring harness	Defective Bkup speed sensor, wiring harness
Questions	Confirm recent repair history							
	Degree of use of machine	Operated for long period			△			
	Condition of hunting	Occurs at a certain speed range					○	○
		Occurs at low idle		○	○	○	○	○
		Occurs even when speed is raised		○			○	○
		Occurs on slopes	○					
	Replacement of filters has not been carried out according to Operation and Maintenance Manual				○			
	When fuel tank is inspected, it is found to be empty		○					
	Air breather hole of fuel tank cap is clogged			○				
	Rust and water are found when fuel tank is drained				○			
Check items	Fuel is leaking from fuel piping				○			
	When priming pump is operated, it makes no reaction or it is heavy				○	○		
Troubleshooting	When air is bled from fuel system, air comes out				●			
	Inspect fuel filter, strainer directly					●		
	When a cylinder is cut out for reduced cylinder mode operation, engine speed does not change					●		
	Carry out troubleshooting according to "Eng Ne Speed Sensor Error (*1)" indicated by code						●	
	Carry out troubleshooting according to "Eng Bkup Speed Sensor Error (*2)" indicated by code							●
	Remedy		Add	Clean	Replace	Replace	Replace	Replace

*1: Displayed failure codes [CA689]

*2: Displayed failure code [CA778]

S-6 Engine lack output (or lacks power)

General causes why engine lacks output

- Insufficient intake of air
- Insufficient supply of fuel
- Defective spray condition of fuel
- Improper selection of fuel
- There is overheating
→ See "S-14 Coolant temperature becomes too high (Overheating)".
- Controller is controlling in derate mode (limiting injection rate (output) because of an error in electrical system)

		Causes														
		Clogged air cleaner element	Air leakage from air intake piping	Seized turbocharger, interference of turbocharger	Defective contact of valve and valve seat	Improper valve clearance	Worn piston ring, cylinder liner	Clogged air breather hole of fuel tank cap	Leaking, clogged fuel piping	Clogged fuel filter	Stuck, seized supply pump plunger	Clogged injector, defective spray (dirt in injector)	Defective drive of injector (signal, solenoid)	Defective installation of boost pressure sensor (air leakage)	Defective boost pressure sensor, wiring harness	Clogged spill piping
Questions	Confirm recent repair history															
	Degree of use of machine	Operated for long period	△			△	△			△						
	Power was lost	Suddenly		○	○								○	○	○	○
		Gradually		○		○	○			○	○	○		○		
	Non-specified fuel is being used									○	○	○				
	Replacement of filters has not been carried out according to Operation and Maintenance Manual			○						○						
	Engine oil must be added more frequently					○	○									
	Dust indicator is red			○	○											
	Air breather hole of fuel tank cap is clogged							○								
	Fuel is leaking from fuel piping								○							
Check items	Output becomes insufficient after short stop of operation			○												
	Colour of exhaust gas	Black		○	○		○									
		Blue under light load					○									
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low											○	○			
	When engine is cranked, interference sound is generated around turbocharger				○											
	When engine is cranked, abnormal sound is generated around cylinder head					○										
	High idle speed is too high												○			
	High idle speed under no load is normal, but speed suddenly drops when load is applied							○		○	○	○				
	Engine does not pick up smoothly and combustion is irregular			○	○			○	○			○				
	There is hunting from engine (rotation is irregular)							○	○	○		○	○			
	Blow-by gas is excessive				○		○									

Troubleshooting	Inspect air cleaner directly	●														
	Inspect air intake piping directly		●													
	When boost pressure is measured, it is found to be low	●	●	●												
	When compression pressure is measured, it is found to be low				●		●									
	Inspect valve clearance directly					●										
	Inspect fuel piping								●							
	Inspect fuel filter, strainer directly									●						
	Inspect spill port check valve directly														●	
	Carry out troubleshooting according to "Rail Press (Very) Low Error (*1)" indicated by code										●					
	When a cylinder is cut out for reduced cylinder mode operation, engine speed does not change											●	●			
	Inspect boost pressure sensor mount directly													●		
	Carry out troubleshooting according to "Chg Air Press Sensor High (Low) Error (*2)" indicated by code														●	
	Remedy	Clean	Correct	Replace	Replace	Adjust	Replace	Clean	Correct	Replace	Replace	Replace	Replace	Correct	Replace	Replace

*1: Displayed failure codes [CA559] and [CA2249]

*2: Displayed failure codes [CA122] and [CA123]

S-7 Exhaust smoke is black (incomplete combustion)

General causes why exhaust smoke is black

- Insufficient intake of air
- Defective condition of fuel injection
- Improper selection of fuel
- There is overheating
→ See "S-14 Coolant temperature becomes too high (Overheating)".
- Controller is controlling in derate mode (limiting injection rate (output) because of an error in electrical system)

		Causes												
Questions		Clogged air cleaner element	Seized turbocharger, interference of turbocharger	Defective contact of valve and valve seat	Improper valve clearance	Leakage of air between turbocharger and cylinder head	Crushed, clogged muffler	Worn piston ring, cylinder liner	Stuck, seized supply pump plunger	Clogged, seized injector	Abnormally worn injector	Improper fuel injection timing	Improper fuel injection pressure	Defective coolant temperature sensor, wiring harness
Check items	Confirm recent repair history													
	Degree of use of machine	Operated for long period	△	△				△		△				
	Colour of exhaust gas	Suddenly became black		○		○			○	○	○			
		Gradually became black	○			○				○				
		Blue under light load						○						
	Non-specified fuel is being used								○	○				
	Oil must be added more frequently							○						
	Power was lost	Suddenly		○			○		○	○				
		Gradually	○		○		○							
	Dust indicator is red	○												
	Muffler is crushed					○								
	Air leaks between turbocharger and cylinder head, clamp is loosened					○								
	Engine is operated in low-temperature mode at normal temperature											○	○	○
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low								○	○				
	When engine is cranked, interference sound is generated around turbocharger		○											
	When engine is cranked, abnormal sound is generated around cylinder head				○									
	Pump relief speed is high (Fuel is injected excessively)										○			
	Exhaust noise is abnormal		○				○			○				
Troubleshooting	Engine does not pick up smoothly and combustion is irregular		○		○	○		○	○	○				
	Blow-by gas is excessive						○							
	If spill hose from injector is disconnected, abnormally much fuel spills									○				
	Inspect air cleaner directly	●												
	When turbocharger is rotated by hand, it is found to be heavy		●											
	When compression pressure is measured, it is found to be low			●				●						
	Inspect valve clearance directly				●									
	When muffler is removed, exhaust colour improves						●							
	Carry out troubleshooting according to "Rail Press (Very) Low Error (*1)" indicated by code								●		●			
	When a cylinder is cut out for reduced cylinder mode operation, engine speed does not change									●				
Remedy	Carry out troubleshooting according to "Coolant Temp Sens High (Low) Error (*2)" indicated by code													●
	Check with monitoring function											●	●	
		Clean	Replace	Replace	Adjust	Correct	Replace	Replace	Replace	Replace	Replace	Adjust	Replace	Replace

*1: Displayed failure codes [CA559] and [CA2249]

*2: Displayed failure codes [CA144] and [CA145]

S-8 Oil consumption is excessive (or exhaust smoke is blue)

General causes why oil consumption is excessive

- Abnormal consumption of oil
- Long-time operation of engine at low idle or high idle (Do not run engine at idle for more than 20 minutes continuously)
- External leakage of oil
- Wear of parts in lubrication system

		General causes why oil consumption is excessive	Causes														
			Dust sucked in from intake system	Worn, damaged valve (stem, guide, seal)	Turbocharger		Clogged breather, breather hose	Broken piston ring	Worn piston ring, cylinder liner	Worn, damaged rear oil seal	Broken oil cooler	Oil leakage from oil cooler	Oil leakage from oil filter	Oil leakage from oil piping	Oil leakage from oil drain plug	Oil leakage from oil pan, cylinder head, etc.	
																	Worn seal at turbocharger end
Questions	Confirm recent repair history																
	Degree of use of machine	Operated for long period		△	△	△			△								
	Oil consumption suddenly increased							○			○						
	Oil must be added more frequently								○		○						
	Oil becomes contaminated quickly						○	○	○								
	Outside of engine is dirty with oil												○	○	○	○	○
	There are loose piping clamps in intake system			○													
	Inside of turbocharger intake outlet pipe is dirty with oil					○											
	Inside of turbocharger exhaust outlet pipe is dirty with oil			○	○												
	There is oil in coolant											○					
	Oil level in damper chamber of applicable machine is high										○						
	Exhaust smoke is blue under light load							○	○								
Check items	Amount of blow-by gas	Excessive		○		○		○	○								
		None				○											

Troubleshooting	When intake manifold is removed, dust is found inside	●														
	When intake manifold is removed, inside is found to be dirty abnormally		●													
	Excessive play of turbocharger shaft			●	●											
	Check breather and breather hose directly					●										
	When compression pressure is measured, it is found to be low						●	●								
	Inspect rear oil seal directly								●							
	Pressure-tightness test of oil cooler shows there is leakage									●	●					
	There is external leakage of oil from engine											●	●	●	●	
	Remedy		Correct	Correct	Replace	Replace	Clean	Replace	Replace	Correct	Replace	Replace	Correct	Correct	Correct	Correct

S-9 Oil becomes contaminated quickly

General causes why oil becomes contaminated quickly

- Entry of exhaust gas into oil due to internal wear
- Clogging of lubrication passage
- Use of improper fuel
- Use of improper oil
- Operation under excessive load

		Causes								
Questions			Defective seal at turbocharger turbine end	Worn valve, valve guide	Worn piston ring, cylinder liner	Clogged breather, breather hose	Clogged oil cooler	Clogged oil filter	Defective oil filter safety valve	Clogged turbocharger lubrication drain tube
	Confirm recent repair history									
	Degree of use of machine	Operated for long period	△	△	△					
	Non-specified fuel is being used				○			○		
	Engine oil must be added more frequently				○					
	Metal particles are found when oil is drained			○	○			○		
	Inside of exhaust pipe is dirty with oil			○						
Check items	Engine oil temperature rises quickly						○			
	Colour of exhaust gas colour	Blue under light load			○					
		Black								○
	Amount of blow-by gas	Excessive	○	○	○					○
		None				○				

Troubleshooting	Excessive play of turbocharger shaft	●								
	When compression pressure is measured, it is found to be low		●	●						
	Check breather and breather hose directly				●					
	Inspect oil cooler directly					●				
	Inspect oil filter directly						●			
	Spring of oil filter safety valve is hitched or broken							●		
	Inspect turbocharger lubrication drain tube directly								●	
Remedy		Replace	Replace	Replace	Clean	Clean	Replace	Replace	Clean	See S-7
										—

S-10 Fuel consumption is excessive

General causes why fuel consumption is excessive

- Leakage of fuel
- Defective condition of fuel injection (fuel pressure, injection timing)
- Excessive injection of fuel

General causes why fuel consumption is excessive			Causes									
			Fuel leakage inside head cover	Fuel leakage from fuel filter, piping, etc.	Defective feed pump oil seal	Defective supply pump plunger	Defective common rail pressure	Defective spray by injector	Defective operation of injector	Improper fuel injection timing	Defective coolant temperature sensor, wiring harness	
Questions	Confirm recent repair history											
	Degree of use of machine	Operated for long period			△	△		△				
	Condition of fuel consumption	More than for other machines of same model					○		○	○	○	
		Gradually increased				○		○				
Suddenly increased			○	○								
Check items	There is external leakage of fuel from engine			○								
	Combustion is irregular							○				
	Engine oil level rises and oil smells of diesel fuel		○		○							
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low							○				
	Low idle speed is high								○			
	Pump relief speed is high								○			
	Exhaust smoke colour	Black					○	○		○	○	
		White		○								
	Troubleshooting	Remove and inspect head cover directly		●								
Inspect feed pump oil seal directly				●								
Carry out troubleshooting according to "Rail Press (Very) Low Error (*1)" indicated by code					●							
When a cylinder is cut out for reduced cylinder mode operation, engine speed does not change							●					
If spill hose from injector is disconnected, much fuel spills								●				
Carry out troubleshooting according to "Coolant Temp Sens High (Low) Error (*2)" indicated by code											●	
Check with monitoring function						●			●			
		Remedy	Correct	Correct	Replace	Replace	Correct	Replace	Replace	Replace	Replace	

*1: Displayed failure codes [CA559] and [CA2249]

*2: Displayed failure codes [CA144] and [CA145]

S-11 Oil is in coolant (or coolant spurts back or coolant level goes down)

General causes why oil is in coolant

- Internal leakage in lubrication system
- Internal leakage in cooling system

		Causes			
		Broken cylinder head, head gasket	Internal cracks in cylinder block	Holes caused by pitting	Broken oil cooler core, O-ring
Check Items	Confirm recent repair history				
	Degree of use of machine	Operated for long period		△	△
	Oil level	Suddenly increased	○		○
		Gradually increased		○	○
	Hard water is being used as coolant			○	○
	Oil level has risen, oil is milky		○	○	◎
	There are excessive air bubbles in radiator, coolant spurts back		◎		
Trouble- shooting	Pressure-tightness test of cylinder head shows there is leakage		●		
	Inspect cylinder block, liner directly			●	●
	Pressure-tightness test of oil cooler shows there is leakage				●
		Remedy	Replace	Replace	Replace
			Replace	Replace	Replace

S-12 Oil pressure drops

General causes why oil pressure drops

- Leakage, clogging, wear of lubrication system
- Defective oil pressure control
- Improper selection of fuel (improper viscosity)
- Deterioration of oil due to overheating

		Causes									
		Worn journal of bearing	Lack of oil in oil pan	Coolant, fuel in oil	Clogged strainer in oil pan	Clogged, broken pipe in oil pan	Defective oil pump	Defective regulator valve	Clogged oil filter	Leaking, crushed, clogged hydraulic piping	Defective oil level sensor, wiring harness
Questions	Confirm recent repair history										
	Degree of use of machine	Operated for long period	△				△		△		
	Oil pressure monitor indicates low oil pressure							○	○		
	Non-specified oil is being used		○						○		
	Replacement of filters has not been carried out according to Operation and Maintenance Manual								○		
	Oil pressure monitor (if installed)	Indicates pressure drop at low idle	○								
		Indicates pressure drop at low, high idle		○	○	○	○				
		Indicates pressure drop on slopes		○							
		Sometimes indicates pressure drop						○			○
	Oil level monitor indicates oil level drop		○								○
Check items	Oil level in oil pan is low		○								
	External hydraulic piping is leaking, crushed									○	
	Oil is milky or smells of diesel oil			○							
	Metal particles are found when oil pan is drained	○									
	Metal particles are found when oil filter is drained	○					○				
Troubleshooting	Metal particles are found in oil filter	●									
	Inspect oil pan strainer, pipe directly				●	●					
	Oil pump rotation is heavy, there is play in oil pump						●				
	Valve spring of regulator valve is fatigued, damaged							●			
	Inspect oil filter directly								●		
	If oil level sensor is replaced, oil pressure monitor indicates normally										●
Remedy		Clean	Add	—	Clean	Clean	Replace	Adjust	Clean	Correct	Replace

S-13 Oil level rises (Entry of coolant/fuel)

General causes why oil level rises

- Coolant in oil (milky)
- Fuel in oil (smells diluted diesel fuel)
- ★ If oil is in coolant, carry out troubleshooting for "S-11 Oil is in coolant"

		Causes							
		Broken cylinder head, head gasket	Broken injector O-ring	Cracks inside cylinder block	Holes caused by pitting	Worn, damaged rear oil seal	Broken oil cooler core, O-ring	Defects in supply pump	Defective seal of auxiliary equipment (pump, compressor)
Questions	Confirm recent repair history								
	Degree of use of machine		△		△	△			△
	Fuel must be added more frequently		○					○	
	Coolant must be added more frequently	○		○					
Check items	There is oil in coolant	○	○	○	○		○		
	Oil smells of diesel fuel		○					○	
	Oil is milky	○			○				
	When engine is started, drops of water come from muffler	○							
	When radiator cap is removed and engine is run at low idle, an abnormal number of bubbles appear, or coolant spurts back	○			○				
	Exhaust smoke is white		○						
	Oil level in damper chamber is low					○			
	Oil level in hydraulic tank is low								○
Troubleshooting	When compression pressure is measured, it is found to be low	●							
	Remove injector and inspect O-ring		●						
	Inspect cylinder block, liner directly			●	●				
	Inspect rear oil seal directly					●			
	Pressure-tightness test of oil cooler shows there is leakage						●		
	Remove and inspect supply pump directly							●	
	Inspect seal of auxiliary equipment directly								●
Remedy		Replace	Correct	Replace	Replace	Correct	Replace	Replace	Replace

S-14 Coolant temperature becomes too high (overheating)

General causes why coolant temperature becomes too high

- Lack of cooling air (deformation, damage of fan)
- Drop in heat dissipation efficiency
- Problem in coolant circulation system

		Causes										
		Broken cylinder head, head gasket	Holes caused by pitting	Clogged, broken oil cooler	Lack of coolant	Broken water pump	Defective operation of thermostat	Clogged, crushed radiator fins	Clogged radiator core	Defective radiator cap (pressure valve)	Slipping fan belt, worn fan pulley	Defective coolant temperature gauge
Questions	Confirm recent repair history											
	Degree of use of machine	Operated for long period	△	△				△	△			
	Condition of overheating	Sudden overheated			○	○					○	
		Always tends to overheat					○	○	○		○	
Check items	Coolant temperature gauge (if installed)	Rises quickly			○		○					
		Does not go down from red range										○
	Radiator coolant level monitor indicates drop of coolant level (if monitor is installed)				○							
	Engine oil level has risen and oil is milky			○	○							
	Fan belt tension is low										○	
	When fan belt is turned, it has play					○						
	Milky oil is floating on coolant				○							
	There are excessive air bubbles in radiator, coolant spurts back		○									
	When light bulb is held behind radiator core, no light passes through							○				
	Radiator shroud, inside of underguard are clogged with dirt or mud							○			○	
	Coolant is leaking because of cracks in hose or loose clamps				○							
	Coolant flows out from radiator overflow hose									○		
	Fan belt whines under sudden acceleration										○	
	Hydraulic oil temperature enters red range faster than engine coolant temperature											○
Troubleshooting	When compression pressure is measured, it is found to be low		●									
	Inspect cylinder liner directly			●								
	Inspect oil cooler directly				●							
	Temperature difference between upper and lower tanks of radiator is large					●						
	When operation of thermostat is carried out, it does not open at cracking temperature						●					
	Temperature difference between upper and lower tanks of radiator is slight							●				
	Inspect radiator core directly								●			
	When operation of radiator cap is carried out, its cracking pressure is low									●		
	Inspect fan belt, pulley directly										●	
	When coolant temperature is measured, it is found to be normal											●
		Remedy	Replace	Replace	Replace	Add	Replace	Replace	Correct	Correct	Replace	Correct
			Replace								Replace	
			Carry out troubleshooting on applicable machine side									
			—									

S-15 Abnormal noise is made

General causes why abnormal noise is made

- Abnormality due to defective parts
- Abnormal combustion
- Air sucked in from intake system
- ★ Judge if the noise is an internal noise or an external noise before starting troubleshooting.
- ★ The engine is operated in the low-temperature mode while it is not warmed up sufficiently. Accordingly, the engine sound becomes a little larger. This does not indicate abnormality, however.
- ★ When the engine is accelerated, it is operated in the acceleration mode and its sound becomes a little larger for up to about 3 seconds. This does not indicate abnormality, however.

		Causes											
		Leakage of air between turbocharger and cylinder head	Interference of turbocharger, seized turbocharger	Broken dynamic valve system (valve, rocker lever)	Defective inside of muffler (dividing board out of position)	Improper valve clearance	Excessive wear of piston ring, cylinder liner	Improper gear train backlash	Removed, seized bushing	Deformed cooling fan, loose fan belt, interference of fan belt	Clogged, seized injector	Dirt caught in injector	Improper fuel injection timing (abnormality in coolant low temperature sensor, boost temperature sensor)
Questions	Confirm recent repair history												
	Degree of use of machine	Operated for long period					△						
	Condition of abnormal noise	Gradually occurred					○		○				
		Sudden occurred	○	○					○				
	Non-specified fuel is being used									○			
	Oil must be added more frequently						○						
	Metal particles are found when oil filter is drained						○	○					
	Air leaks between turbocharger and cylinder head	○											
	When engine is cranked, interference sound is generated around turbocharger		○										
	When engine is cranked, abnormal sound is generated around cylinder head			○	○								
Check items	When engine is cranked, beat noise is generated around muffler			○									
	When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low										○	○	
	Colour of exhaust gas	Blue under light load					○						
		Black	○	○		○							
	Engine does not pick up smoothly and combustion is irregular										○		
	Abnormal noise is loud when engine is accelerated					○		○		○	○		
	Blow-by gas is excessive						○						
Troubleshooting	When turbocharger is rotated by hand, it is found to be heavy		●										
	Inspect dynamic valve system directly			●									
	When muffler is removed, abnormal noise disappears				●								
	Inspect valve clearance directly					●							
	When compression pressure is measured, it is found to be low						●						
	Inspect gear train directly							●	●				
	Inspect fan and fan belt directly									●			
	When a cylinder is cut out for reduced cylinder mode operation, engine speed does not change										●	●	
	Abnormal noise is heard only when engine is started											●	
	Confirm with monitoring function												●
Remedy		Replace	Replace	Correct	Replace	Adjust	Replace	Replace	Replace	Correct	Replace	Replace	Replace

S-16 Vibration is excessive

General causes why vibration is excessive

- Defective parts (abnormal wear, breakage)
- Misalignment between engine and chassis
- Abnormal combustion
- ★ If abnormal noise is made and vibration is excessive, carry out trouble-shooting for "S-15 Abnormal noise is made", too.

<div>General causes why vibration is excessive</div> <ul style="list-style-type: none">Defective parts (abnormal wear, breakage)Misalignment between engine and chassisAbnormal combustion <div>★ If abnormal noise is made and vibration is excessive, carry out trouble-shooting for "S-15 Abnormal noise is made", too.</div>			Causes									
			Stuck dynamic valve system (valve, rocker lever)									
			Worn main bearing, connecting rod bearing									
			Improper gear train backlash									
			Worn camshaft bushing									
			Improper injection timing (Abnormality in coolant temperature sensor, boost temperature sensor)									
			Loose engine mounting bolts, broken cushions									
			Broken output shaft, parts in damper									

Questions	Confirm recent repair history										
	Degree of use of machine	Operated for long period		△			△			△	
	Condition of vibration	Suddenly increased	○								○
		Gradually increased		○			○			○	
	Non-specified oil is being used			○			○				
Check items	Metal particles are found when oil filter is drained			◎			◎				
	Metal particles are found when oil pan is drained			◎			◎				
	Oil pressure is low at low idle			○			○				
	Vibration occurs at mid-range speed									○	○
	Vibration follows engine speed					○				○	○
	Exhaust smoke is black		◎					○			

Troubleshooting	Inspect dynamic valve system directly		●							
	Inspect main bearing and connecting rod bearing directly			●						
	Inspect gear train directly				●					
	Inspect camshaft bushing directly					●				
	Check with monitoring function						●			
	Inspect engine mounting bolts and cushions directly							●		
	Inspect inside of damper directly									●

	Remedy	Replace	Replace	Replace	Replace	Replace	Replace	Replace
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PC160LC-7E0, PC180LC/NLC-7E0 Hydraulic excavator

Form No. UEN02119-00

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Printed in Belgium 09-07 (02)

HYDRAULIC EXCAVATOR

PC160LC-7E0

PC180LC-7E0

PC180NLC-7E0

Machine model	Serial number
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PC160LC-7E0	K45001 and up
PC180LC-7E0	K45001 and up
PC180NLC-7E0	K45001 and up

50 Disassembly and assembly

General information on disassembly and assembly

How to read this manual	2
List of adhesives	4
Special tool list	7
Sketches of special tools	10



How to read this manual

1. Removal and installation of assemblies




Special tools

- Special tools which are deemed necessary for removal or installation of parts are described as **A1,···X1** etc. and their part names, part numbers and quantities are described in the special tool list.
- Also the following information is described in the special tool list.
 - 1) Necessity
 - : Special tools that cannot be substituted and should always be used (installed).
 - : Special tools that will be useful if available and are substitutable with commercially available tools.
 - 2) Distinction of new and existing special tools
 - N: Tools newly developed for this model. They respectively have a new part number.
 - R: Tools with upgraded part numbers. They are remodelled from already available tools for other models.
 - Blank: Tools already available for other models. They can be used without any modification.
 - 3) Circle mark ○ in sketch column:
 - The sketch of the special tool is presented in the section of "Sketches of special tools".
 - Part No. of special tools starting with 79*T-***-***: means that they can not be supplied from Komatsu in Japan (i.e. locally made parts).
- ★ General tools that are necessary for removal or installation are described as [1], [2]···etc. and their part names, part numbers and quantities are not described.

Removal

- The "Removal" section contains procedures and precautions for implementing the work, know how and the amount of oil or coolant to be drained.
- Various symbols used in the "Removal" section are explained and listed below.
 - ⚠ : **Precautions related to safety in execution of work.**
 - ★: This mark gives guidance or precautions when doing the procedure.
 - [*1] : This mark shows that there are instructions or precautions for installing parts.
 -  : This mark shows the amount of oil or coolant to be drained.
 -  : Weight of part or component

Installation

- Except where otherwise instructed, installation of parts is done in the reverse order of removal.
- Instructions and precautions for installing parts are shown with [*1] mark in the "Removal" section, identifying which step the instructions are intended for.
- Marks shown in the "Installation" section stand for the following.
 - ⚠ : **Precautions related to safety in execution of work.**
 - ★: This mark gives guidance or precautions when doing the procedure.
 -  : Type of coating material
 -  : Tightening torque
 -  : Quantity of oil or coolant to be added

Sketches of special tools


- Various special tools are illustrated for the convenience of local manufacture.

2. Disassembly and assembly of assemblies




Special tools

- Special tools which are deemed necessary for disassembly and assembly of parts are described as **A1...X1** etc. and their part names, part numbers and quantities are described in the special tool list.
- Also the following information is described in the special tool list.
 - 1) Necessity
 - : Special tools that cannot be substituted and should always be used (installed).
 - : Special tools that will be useful if available and are substitutable with commercially available tools.
 - 2) Distinction of new and existing special tools
 - N : Tools newly developed for this model. They respectively have a new part number.
 - R : Tools with upgraded part numbers. They are remodelled from already available tools for other models.
 - Blank : Tools already available for other models. They can be used without any modification.
 - 3) Circle mark ○ in sketch column:
 - The sketch of the special tool is presented in the section of "Sketches of special tools".
 - Part No. of special tools starting with 79*T-***-****: means that they can not be supplied from Komatsu in Japan (i.e. locally made parts).
- ★ General tools that are necessary for disassembly and assembly are described as [1], [2]...etc. and their part names, part numbers and quantities are not described.

Disassembly

- In "Disassembly" section, the work procedures, precautions and know-how for carrying out those procedures, and quantity of the oil and coolant drained are described.
- The meanings of the symbols used in "Disassembly" section are as follows.
 - ⚠ : **Precautions related to safety in execution of work.**
 - ★ : This mark gives guidance or precautions when doing the procedure.
 -  : Quantity of oil or coolant drained

Assembly

- In "Assembly" section, the work procedures, precautions and know-how for carrying out those procedures, and quantity of the oil and coolant added are described.
- The meanings of the symbols used in "Assembly" section are as follows.
 - ⚠ : **Precautions related to safety in execution of work**
 - ★ : This mark gives guidance or precautions when doing the procedure.
 -  : Type of coating material
 -  : Tightening torque
 -  : Quantity of oil or coolant to be added

Sketches of special tools

- Various special tools are illustrated for the convenience of local manufacture.

List of adhesives

- ★ The recommended coating materials such as adhesives, gasket sealants, and greases used for disassembly and assembly are listed below.
- ★ For coating materials not listed below, use the equivalent of products shown in this list.

Cate- gory	Komatsu code	Part No.	Q'ty	Container	Main features and applications
Adhesive	LT-1A	790-129-9030	150 g	Tube	<ul style="list-style-type: none"> Used to prevent rubber gaskets, rubber cushions, and cork plugs from coming out.
	LT-1B	790-129-9050	20 g (2 pcs.)	Polyethylene container	<ul style="list-style-type: none"> Used for plastic (except polyethylene, polypropylene, tetrafluoroethylene and vinyl chloride), rubber, metal, and non-metal parts which require immediate and strong adhesion.
	LT-2	09940-00030	50 g	Polyethylene container	<ul style="list-style-type: none"> Features: Resistance to heat and chemicals. Used to fix and seal bolts and plugs.
	LT-3	790-129-9060 (Set of adhesive and hardener)	Adhesive: 1 kg Hardener: 500 g	Can	<ul style="list-style-type: none"> Used to stick and seal metal, glass, and plastics.
	LT-4	790-129-9040	250 g	Polyethylene container	<ul style="list-style-type: none"> Used to seal plugs.
	Holtz MH 705	790-129-9120	75 g	Tube	<ul style="list-style-type: none"> Heat-resistant seal used to repair engines.
	ThreeBond 1735	790-129-9140	50 g	Polyethylene container	<ul style="list-style-type: none"> Quick-setting adhesive. Setting time: Within 5 sec. to 3 min. Used mainly to stick metals, rubbers, plastics, and woods.
	Aron-alpha 201	790-129-9130	2 g	Polyethylene container	<ul style="list-style-type: none"> Quick-setting adhesive. Quick-setting type. (max. strength is obtained after 30 minutes) Used mainly to stick rubbers, plastics, and metals.
	Loctite 648-50	79A-129-9110	50 cc	Polyethylene container	<ul style="list-style-type: none"> Features: Resistance to heat and chemicals. Used for fitted portions used at high temperatures.
Gasket sealant	LG-1	790-129-9010	200 g	Tube	<ul style="list-style-type: none"> Used to stick or seal gaskets and packings of power train case, etc.
	LG-5	790-129-9080	1 kg	Polyethylene container	<ul style="list-style-type: none"> Used to seal various threaded portions, pipe joints, and flanges. Used to seal tapered plugs, elbows, and nipples of hydraulic piping.
	LG-6	790-129-9020	200 g	Tube	<ul style="list-style-type: none"> Features: Silicon-based heat and cold-resistant sealant. Used to seal flange surfaces and threaded portions. Used to seal oil pan, final drive case, etc.
	LG-7	790-129-9070	1 kg	Tube	<ul style="list-style-type: none"> Features: Silicon-based quick-setting sealant. Used to seal flywheel housing, intake manifold, oil pan, thermostat housing, etc.
	ThreeBond 1211	790-129-9090	100 g	Tube	<ul style="list-style-type: none"> Gasket sealant used to repair engine.
	ThreeBond 1207B	419-15-18131	100 g	Tube	<ul style="list-style-type: none"> Features: Silicon-based, heat and cold-resistant, vibration-resistant, impact-resistant sealant. Used to seal transfer case, etc.

Category	Komatsu code	Part No.	Q'ty	Container	Main features and applications
Lubricant with molybdenum disulfide	LM-G	09940-00051	60 g	Can	<ul style="list-style-type: none"> To be used as lubricant (anti squeaking) for sliding part.
	LM-P	09940-00040	200 g	Tube	<ul style="list-style-type: none"> To be used for press fit, shrink fit and preventing scratching or seizure of thread. To be used as lubricant for linkage and bearing etc..
Grease	G2-LI G0-LI(*) * For cold region	SYG2-400LI SYG2-350LI SYG2-400LI-A SYG2-160LI SYGA-160CNLI SYG0-400LI-A (*) SYG0-16CNLI (*)	Various kinds	Various kinds	<ul style="list-style-type: none"> Versatile type
	G2-CA	SYG2-400CA SYG2-350CA SYG2-400CA-A SYG2-160CA SYGA-160CNCA	Various kinds	Various kinds	<ul style="list-style-type: none"> To be used for the place where the bearing designed for normal temperature and low load condition is used and contacts water and steam.
	Grease with molybdenum disulphide LM-G(G2-M)	SYG2-400M SYG2-400M-A SYGA-16CNM	400 g x 10 400 g x 20 16 kg	Bellows type Can	<ul style="list-style-type: none"> Used for parts under heavy load. Caution: <ul style="list-style-type: none"> Do not use this grease for ball bearings such as swing circle bearing. Apply this grease to work equipment pins only when installing but do not use it after then.
	Hyper white grease G2-T G0-T(*) *: For cold region	SYG2-400T-A SYG2-16CNT SYG0-400T-A (*) SYG0-16CNT (*)	400 g 16 kg	Bellows type Can	<ul style="list-style-type: none"> Higher anti seizure and heat resistance than grease with molybdenum disulphide Body dirt is not distinctive due to white colour.
	Biological grease G2-B G2-BT(*) *: For heat resistance and heavy load	SYG2-400B SYGA-16CNB SYG2-400BT (*) SYGA-16CNBT (*)	400 g 16 kg	Bellows type Can	<ul style="list-style-type: none"> To be shortly dissolved by a bacteria in nature so that the influence to microorganism and animals and plants is suppressed to the minimum.
Primer	Sunstar primer for painting plane 580 super	417-926-3910	20 ml	Glass container	For adhesion of cab glass <ul style="list-style-type: none"> To be used as primer for cab side. (Term of validity: 4 months after manufacturing) To be used as primer for glass side. (Term of validity: 4 months after manufacturing) To be used as primer for painting plane of cab side. (Term of validity: 4 months after manufacturing) To be used as primer for black ceramic coated plane of glass side and polycarbonate hard coat plane. (Term of validity: 4 months after manufacturing) To be used as primer for sash (Alumite surface treatment) (Term of validity: 4 months after manufacturing)
	Sunstar primer for glass 580 super		20 ml	Glass container	
	Sunstar primer for painting plane 435-95	22M-54-27230	20 ml	Glass container	
	Sunstar primer for glass 435-41	22M-54-27240	150 ml	Steel can	
	Sunstar primer for sash GP-402	22M-54-27250	20 ml	Glass container	

Category	Komatsu code	Part No.	Q'ty	Container	Main features and applications
Adhesive compound	Sunstar penguin seal 580 super "S" or "W"	417-926-3910	320 ml	Polyethylene container	<ul style="list-style-type: none"> "S" and "W" are used as glass adhesive compound in high temperature (April - October) and in low temperature (October - April) respectively. (Term of validity: 4 months after manufacturing)
	Sika Ltd, Japan Sika Flex 256HV	20Y-54-39850	310 ml	Polyethylene container	<ul style="list-style-type: none"> To be used as glass adhesive compound. (Term of validity: 6 months after manufacturing)
	Sunstar penguin super 560	22M-54-27210	320 ml	ECOCART (special container)	<ul style="list-style-type: none"> To be used as glass adhesive compound. (Term of validity: 6 months after manufacturing)
Caulking compound	Sunstar penguin seal No. 2505	417-926-3920	320 ml	Polyethylene container	<ul style="list-style-type: none"> To be used as seal for joints of glass. (Term of validity: 4 months after manufacturing)
	Sekisui silicone sealant	20Y-54-55130	333 ml	Polyethylene container	<ul style="list-style-type: none"> To be used for seal of front window. (Term of validity: 6 months after manufacturing)
	GE Toshiba Silicones Tosseal 381	22M-54-27220	333 ml	Cartridge	<ul style="list-style-type: none"> To be used as seal for joints of glass. semi-transparent white seal (Term of validity: 12 months after manufacturing)

Special tool list

- ★ Tools with part number 79○T-○○○-○○○ cannot be supplied (they are items to be locally manufactured).
- ★ Necessity : ■ Cannot be substituted, must always be installed (used)
: ● Extremely useful if available or, can be substituted with commercially available part.
- ★ New/Remodel: N. Tools with new part numbers, newly developed for this model.
: R. Tools with upgraded part numbers, remodelled from items already available for other models.
: Blank . . Tools already available for other models, can be used without any modification
- ★ Tools marked with ○ in the Sketch column are tools introduced in the sketches of the special (See Sketches of special tools).

Component	Sym- bol	Part No.	Part Name	Necessity	Q'ty	New/remodel	Sketch	Nature of work, remarks	
Cylinder head assembly, Fuel injection pump assembly	A	1	795-799-6700	Puller	■	1		Removal of fuel injector	
		2	795-799-1131	Gear	■	1		Positioning of No. 3 and No. 4 top	
		3	795-799-8150	Remover	●	1		Removal of inlet connector	
Engine front seal		4	795-799-6400	Seal puller	■	1		Installation of front seal	
Engine rear seal		5	795-799-6500	Seal puller	■	1		Installation of rear seal	
Cylinder head assembly		6	790-331-1120	Wrench (Angle)	●	1		Tightening of bolt	
		7	795-790-4510	Gauge	●	1		Measurement of cylinder head bolt length	
Engine and hydraulic pump assembly	D	796-460-1210	Oil stopper	●	1			Oil stopper	
		796-770-1320	Adapter	●	1				
Centre swivel joint assembly	E	790-101-2501	Push puller (Kit)	●	1			Disassembly of centre swivel joint assembly	
		790-101-2510	• Block		1				
		790-101-2520	• Screw		1				
		791-112-1180	• Nut		1				
		790-101-2540	• Washer		1				
		790-101-2630	• Leg		2				
		790-101-2570	• Plate		4				
		790-101-2560	• Nut		2				
		790-101-2650	• Adapter		2				
Final drive assembly	F	1	796-427-1200	Wrench	■	1		Removal, installation of nut	
		796T-427-1220	Push tool	■	1		○	Installation of bearing	
		790-101-2510	Block	■	1				
		792-104-3940	Bolt	■	2				
		01580-11613	Nut	■	2				
		01613-31645	Washer	■	2				
		790-105-2100	Jack	■	1				
		790-101-1102	Pump	■	1				
	3	791-545-1510	Installer	■	1			Installation of floating seal	
Swing motor and swing machinery assembly	G	1	KBATZ080080	Wrench	■	1		Removal, installation of ring nut	
		2	KBATZ030190	Adapter	■	1			
		3	KBATZ060400	Stopper	■	1			

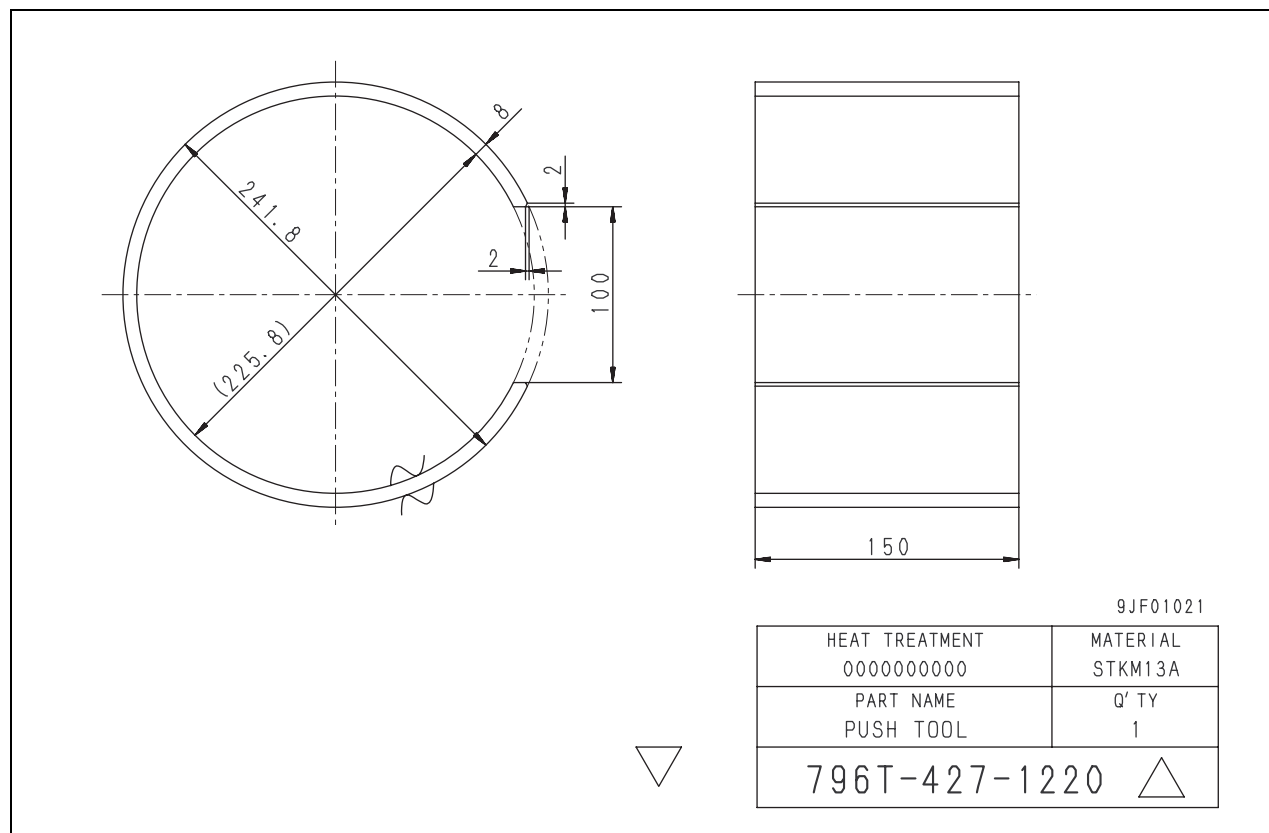
Component	Sym- bol	Part No.	Part Name	Necessity	Q'ty	New/remodel	Sketch	Nature of work, remarks
Idler assembly	H	790-101-5201	Push tool KIT	●	1			Press fitting of bushing
		790-101-5221	• Grip		1			
		01010-51225	• Bolt		1			
		790-101-5271	• Plate		1			
	2	790-434-1630	Installer	■	1			Installation of floating seal
	3	791-601-1000	Oil pump	●	1			Filling with oil
Recoil spring assembly	J	791-600-2001 or 791-685-8006	Compressor (A) Compressor (B)	■ ■	1 1			Disassembly and assembly of recoil spring assembly
		790-201-2780	Spacer					
		791-635-3160	Extension	■	1			
		790-101-1600	Cylinder (686 kN {70 ton})	■	1			
		790-101-1102	Pump	■	1			
		790-640-2180	Guide bolt	■	1			
		790-101-5201	Push tool kit (B)	●	1			
	2	790-101-5241	• Plate		1			
		790-101-5221	• Grip		1			
		01010-51225	• Bolt		2			
		790-201-1500	Push tool kit	●	1			
	3	790-201-1620	• Plate		1			
		790-101-5021	• Grip		1			
		01010-50816	• Bolt		1			
Carrier roller assembly	L	790-434-1660	Installer	■	1			Installation of floating seal
Track roller assembly		796-670-1020	Installer	■	1			
Idler assembly		791-530-1510	Installer	■	1			
Track shoe assembly	M	791-630-3000	Remover and installer	■	1			Expansion and installation of track shoe assembly
		790-101-1300	Cylinder	■	1			
		790-101-1102	Pump	■	1			
		790-331-1110	Wrench	■	1			
Hydraulic pump input shaft oil seal	N	791-463-1350	Push tool	■	1			Press fitting of oil seal
		790-201-2740	Spacer	■	1			

Component	Sym- bol	Part No.	Part Name	Necessity	Q'ty	New/remodel	Sketch	Nature of work, remarks
Hydraulic cylinder assembly	Q	1	790-502-1003	Cylinder repair stand	■	1		Disassembly, assembly of hydraulic cylinder assembly
		2	790-102-4300	Wrench assembly	■	1		Removal, installation of piston
			790-102-4310	Pin	■	2		
		3	790-720-1000	Expander	●	1		Installation of piston ring
		4	796-720-1660	Ring (for boom and bucket)	●	1		
			07281-01159	Clamp (for boom and bucket)	●	1		
			796-720-1670	Ring (for arm)	●	1		
			07281-01279	Clamp (for arm)	●	1		
		5	790-201-1702	Push tool KIT	■	1		Press fitting of cylinder head bushing
			790-201-1821	• Push tool (for boom)		1		
			790-201-1940	• Push tool (for arm)		1		
			790-201-1811	• Push tool (for bucket)		1		
			790-101-5021	• Grip		1		
			01010-50816	• Bolt		1		
		6	790-201-1500	Push tool KIT	●	1		Installation of dust seal
			790-201-5021	• Grip		1		
			01010-50816	• Bolt		1		
			790-201-1630	• Plate (for boom)		1		
			790-201-1620	• Plate (for bucket)		1		
			790-201-1980	Plate (for arm)	●	1		
			790-201-5021	Grip	●	1		
			01010-50816	Bolt	●	1		
Work equipment assembly	R		796-900-1200	Remover	■	1		Removal of foot pin
			790-101-4000	Puller (490 kN {50 t}, long)	■	1		
			790-101-1102	Pump (294 kN {30})	■	1		
Air conditioner unit assembly	S		799-703-1200	Service tool KIT	■	1		Collection of and refilling with refrigerant
			799-703-1100	Vacuum pump (100 V)	■	1		
			799-703-1111	Vacuum pump (220 V)	■	1		
			799-703-1121	Vacuum pump (240 V)	■	1		
			799-703-1401	Gas leak detector	■	1		
Operator's cab glass (Stuck glass)	X	1	793-498-1210	Lifter (Suction cup)	■	2		Fixing of window glass
		2	20Y-54-13180	Seat	■	2		

Sketches of special tools

Note: Komatsu cannot accept any responsibility for special tools manufactured according to these sketches

F2 PUSH TOOL



PC160LC-7E0, PC180LC/NLC-7E0 Hydraulic Excavator

Form No. UEN02447-00

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Printed in Belgium 09-07 (02)

HYDRAULIC EXCAVATOR

PC160LC-7E0

PC180LC-7E0

PC180NLC-7E0

Machine model	Serial number
---------------	---------------

PC160LC-7E0	K45001 and up
PC180LC-7E0	K45001 and up
PC180NLC-7E0	K45001 and up

50 Disassembly and assembly

Engine and cooling system

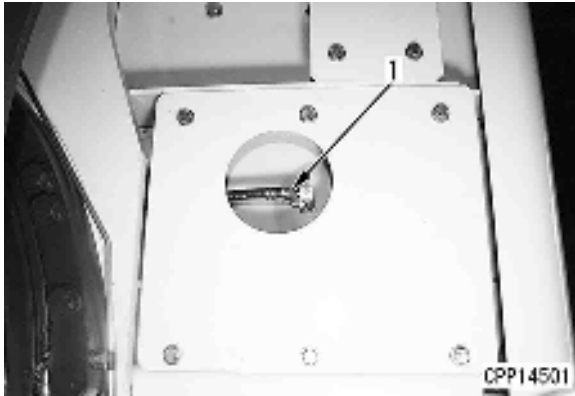
Removal and installation of fuel supply pump assembly	2
Removal and installation of fuel injector assembly	5
Removal and installation of front oil seal	10
Removal and installation of rear oil seal	12
Removal and installation of cylinder head assembly	15
Removal and installation of radiator assembly	25
Removal and installation of aftercooler assembly	27
Removal and installation of work equipment oil cooler assembly	29
Removal and installation of engine and hydraulic pump assembly	31
Removal and installation of engine hood assembly	38
Removal and installation of fuel tank assembly	40

Removal and installation of fuel supply pump assembly

Removal

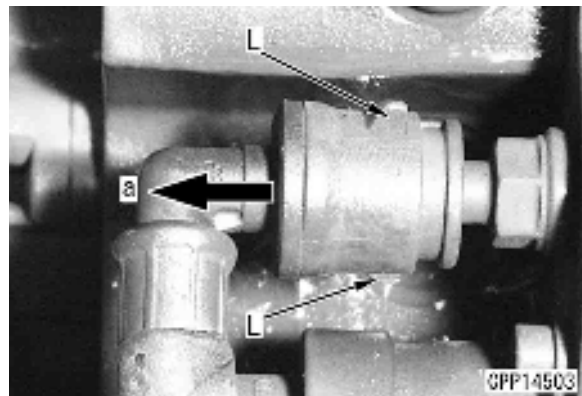
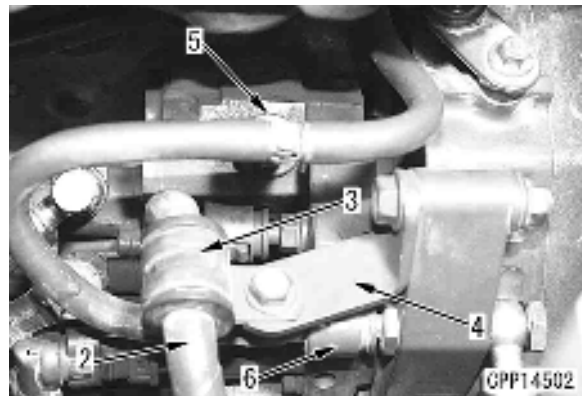
- ⚠ **Disconnect the cable from the negative (–) terminal of the battery.**

1. Close fuel stop valve (1) under the fuel tank.

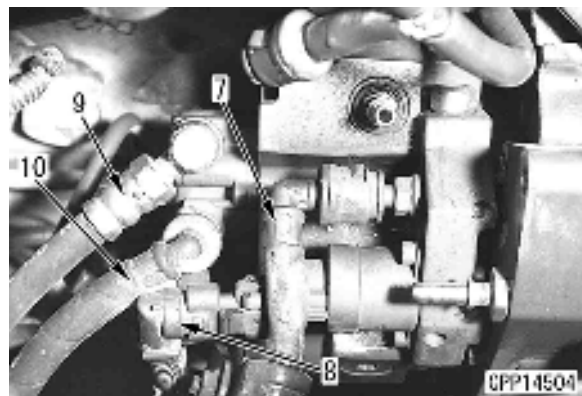


2. Open the engine hood.
3. Disconnect clamp (3) of fuel hose (2) from bracket (4).
 - ★ When loosening the bolt, fix the nut with wrench so that the hose will not be twisted.
(If the hose is dragged and twisted, an excessive force is applied to the connector and the inside of the connector may be broken.)
4. Remove clamp bracket (4).
5. Disconnect fuel return hose connector (5) connected to the supply pump. [*1]
 - ★ When removing a connector of quick coupler type, observe the following points.
 - Remove mud from each hose joint in advance (since the lock may be stuck in the mud).
 - Never use pliers or a screwdriver to disconnect the connector.
 - Pull out lock (L) of each hose joint straight (in direction [a]) while pressing it from both sides.
(If the connector is disconnected forcibly by twisting or bending it to the right and left, its inside may be broken.)
 - Put plugs in the adapters of the disconnected hoses to prevent fuel from flowing out.
(Do not use wooden plugs since chips may enter the fuel line.)

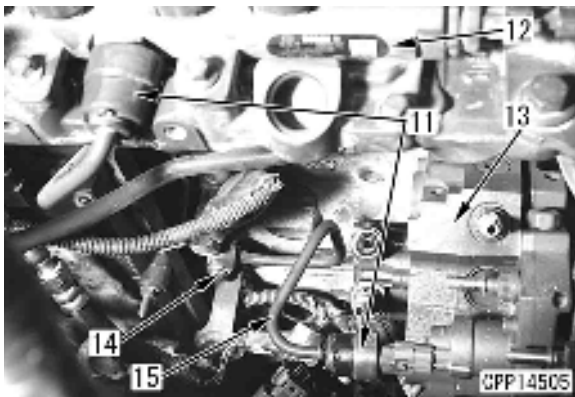
6. Disconnect fuel return hose (6).



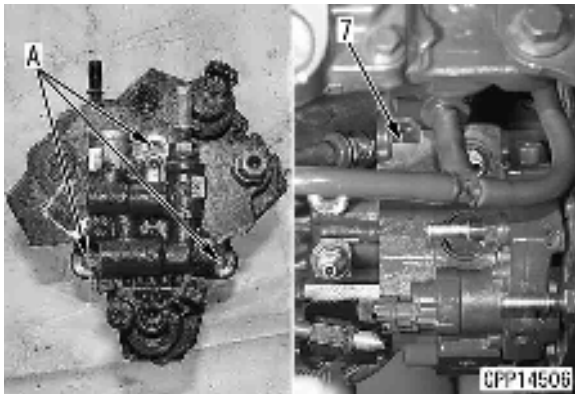
7. Disconnect hose (7) connected to the fuel filter.
 - ★ Before disconnecting hose (7), be sure to perform steps 3 to 5.
8. Disconnect wiring connector (8).
9. Disconnect hose (9) connected to the prefilter. [*2]
10. Disconnect hose (10) connected to the fuel filter.



11. Remove 2 high-pressure pipe bellows (11) from common rail (12) and fuel supply pump (13). [*3]
12. Disconnect 2 high-pressure pipe clamps (14) between the common rail (12) and fuel supply pump (13). [*4]
 - ★ Since each clamps are divided two, take care not to drop them in the end cover when removing.
13. Disconnect high-pressure pipe (15) from fuel supply pump (13). [*5]
 - ★ Loosen the sleeve nut on the common rail side in advance.



14. Remove the 3 fuel supply pump mounting nuts and fuel supply pump assembly (7). (Locations of nuts: [A]) [*6]



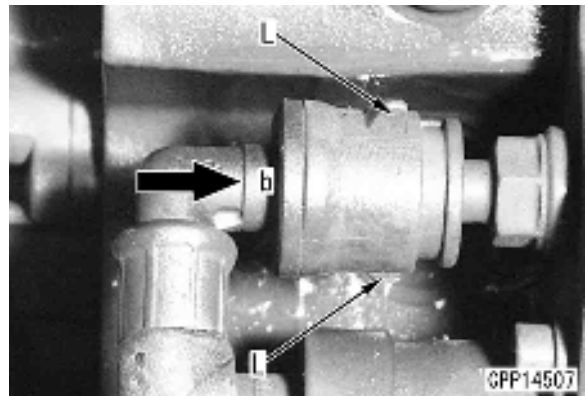
Installation

- Carry out installation in the reverse order to removal.

[*1]

When installing a connector of quick coupler type, observe the following points.

- ★ Replace the connector with new one in the following cases.
 - 1) The connector was removed with pliers or a screwdriver or by bending it to the right and left.
 - 2) There is damage or deformation in the connector.
- ★ Check that mud or dirt is not sticking to the hose adapter in advance.
- ★ Press and insert the connector straight (in direction [b]) without bending it to the right or left.
(If it is difficult to insert the connector, do not push it in forcibly but pull it out. Then, check the convex and concave parts for abnormality and mud.)



[*2]

Joint bolt: **19.6 – 29.4 Nm {2.0 – 3.0 kgm}**

[*3]

- ★ Install each bellows with the slits out and down.
- ★ The bellows are installed so that fuel will not spout over the hot parts of the engine and catch fire when it leaks for some reason.

[*4]

Clamp mounting bolt:
24 ± 4 Nm {2.45 ± 0.41 kgm}

[*5]

- ★ Temporarily tighten the high-pressure pipe sleeve nuts on the common rail side and fuel supply pump side and then tighten them to the specified torque in the order of the pump side and common rail side.

Sleeve nut: **35 ± 3.5 Nm {3.6 ± 0.36 kgm}**

[*6]

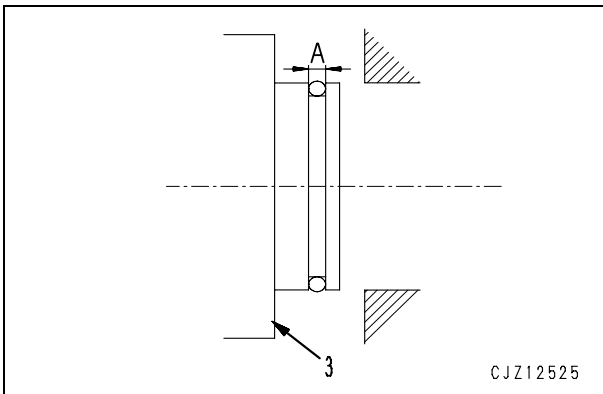
⚠ If too much grease is applied to an O-ring at assembly, it will ooze out during operation. Accordingly, do not apply grease too much. (Apply grease to the O-ring groove area of part A.)

⚠ When the supply pump mounting stud bolts of the gear housing were removed, apply adhesive to their root side and mount them.

🔧 Stud bolt: **Adhesive (LT-2)**

🔧 Stud bolt: **12 ± 2 Nm { 1.22 ± 0.2 kgm}**

🔧 Fuel supply pump mounting nut:
 24 ± 4 Nm { 2.45 ± 0.41 kgm}



Removal and installation of fuel injector assembly

Special tools

Symbol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
A	1	795-799-6700	Puller	■	1		
	2	795-799-1131	Gear	■	1		
	3	795-799-8150	Remover	●	1		

Removal

- ⚠ **Disconnect the cable from the negative (–) terminal of the battery.**

1. Close fuel stop valve (1) under the fuel tank.

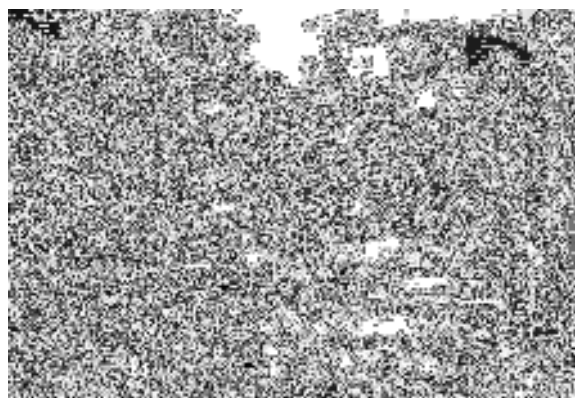


2. Remove blow-by duct (2) mounting bolts and disconnect blow-by duct (2). [*1]
3. Remove cylinder head cover mounting bolts (3) and remove cylinder head cover (4). [*2]

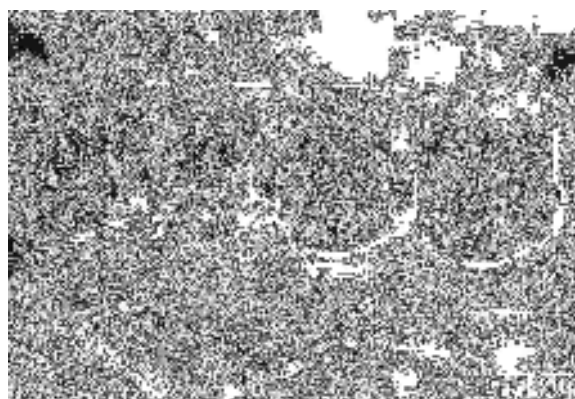


4. Referring to Testing and adjusting, "Adjusting valve clearance", set the No. 1 and 4 cylinders to the top dead centre.

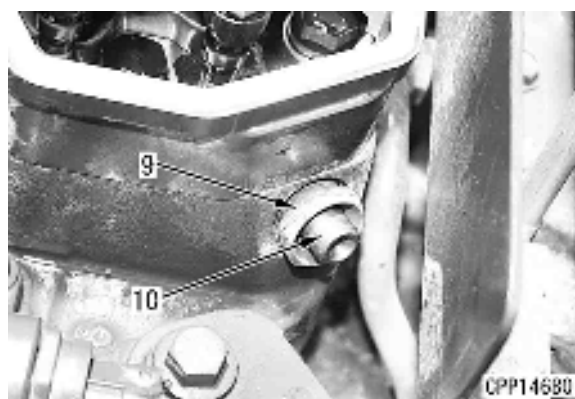
5. Disconnect wiring (5).
6. Disconnect bracket (6).
7. Remove high-pressure pipe bellows (7) from the cylinder head and common rail. [*3]



8. Remove high-pressure pipe (8). [*4]



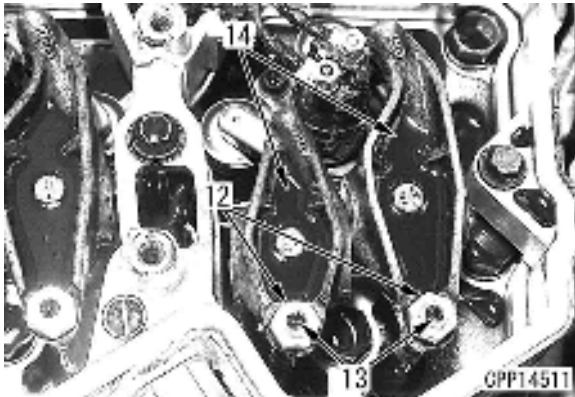
9. Remove retaining nut (9) and then remove inlet connector (10).
 - ★ Tool **A3** is prepared for remove the inlet connector (10).
 - ★ Check that the inlet connector is free from flaw and dirt.



10. Disconnect wiring (11).
 - ★ Since different cylinders have different wiring colours, record their combinations.

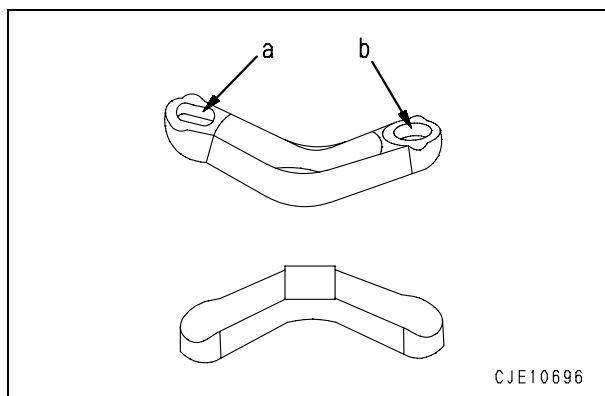
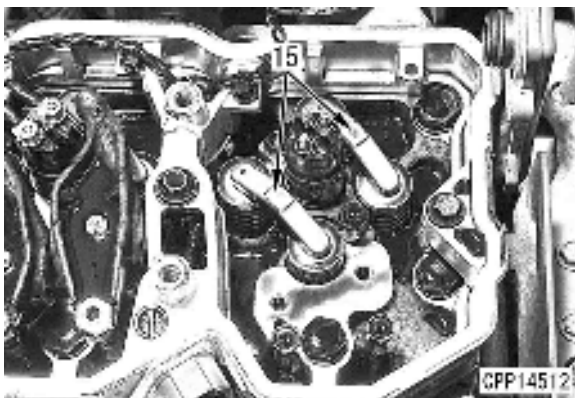
11. Loosen locknut (12) and then loosen adjustment screw (13) thoroughly.

12. Remove rocker arm (14).

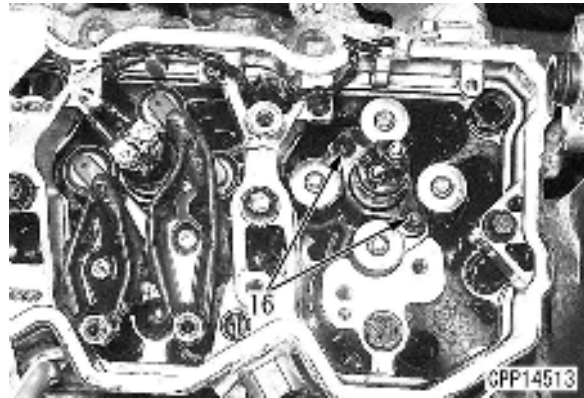


13. Remove crosshead (15).

- ★ Since the shapes of holes [a] and [b] of the crosshead are different, record the installed position of the crosshead.



14. Remove fuel injector assembly mounting bolt (16).



15. Using tool **A1**, remove fuel injector assembly (17).

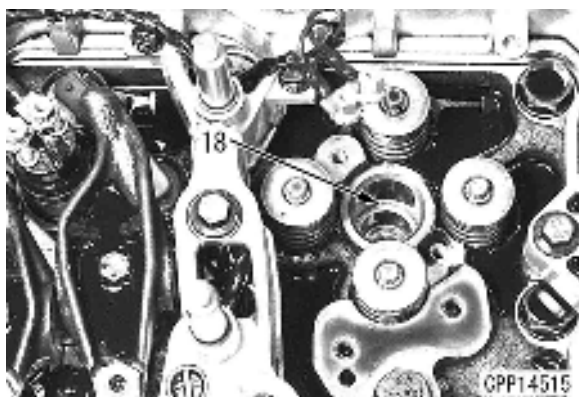
- ★ Cover injector sleeve with cloth after removing fuel injector assembly for free from flaw and dirt.



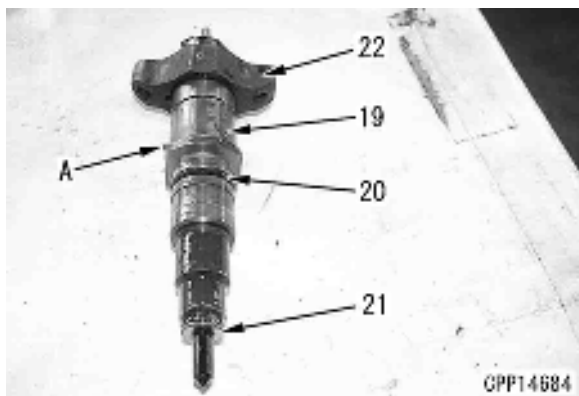
Installation

1. Fuel injector assembly

- ★ Check that fuel injector sleeve (18) is free from flaw and dirt.

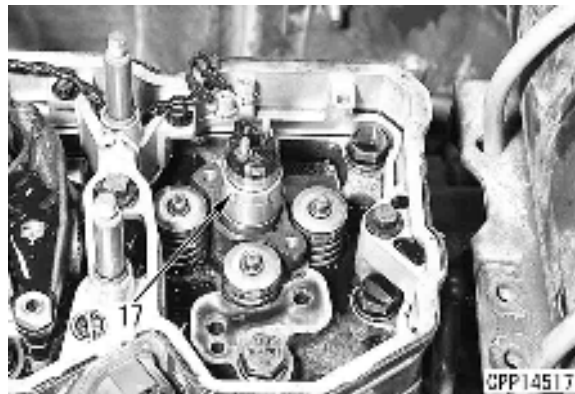


- 1) Fit O-ring (20) and gasket (21) to fuel injector (19).
 - ★ Replace O-ring and gasket with new one.
- 2) Apply engine oil (EO15W-40) to the O-ring of the fuel injector (19) and the mounting hole on the head.
- 3) While setting the concave and convex (A), install holder (22) to fuel injector (19).



- 4) Install fuel injector assembly (17) to the fuel injector sleeve and tighten the mounting bolt by 3 – 4 turns.

- ★ When installing the fuel injector assembly, check the direction of the inlet connector mounting hole.



- 5) Apply engine oil (EO15W-40) to O-ring (22) of inlet connector (10) and the inlet connector mounting hole. While setting part of key to the groove on the head, insert inlet connector (10) to the end.

- ★ If the injector was replaced with new one, replace the inlet connector with new one, too.

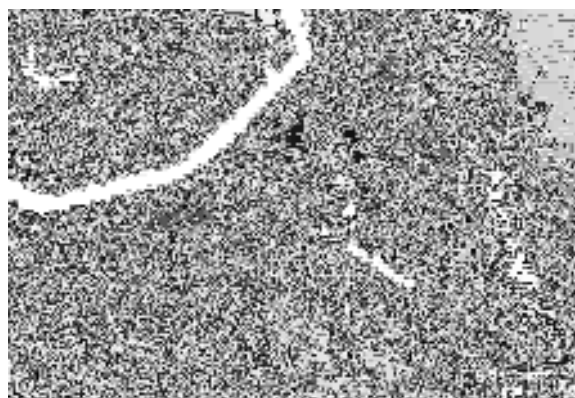
- ★ Check of inlet connector

Check the inlet connector for the following defects. If any defect is detected, replace the inlet connector.

- Burrs and deformation of inlet and outlet of connector
- Clogging and dirt of edge filter (If there is sediment here, do not use connector)
- Breakage and deterioration of O-ring
- Wear, improper contact and trace of leakage on outlet seal

- ★ If high-pressure fuel leaks, the seat surface is eroded and fine streaks or flaws are made.

If this erosion is detected, replace the inlet connector and injector.



- 6) Install and finger-tighten retainer (9).
- 7) Tighten right and left mounting bolts (16) of fuel injector assembly alternately.

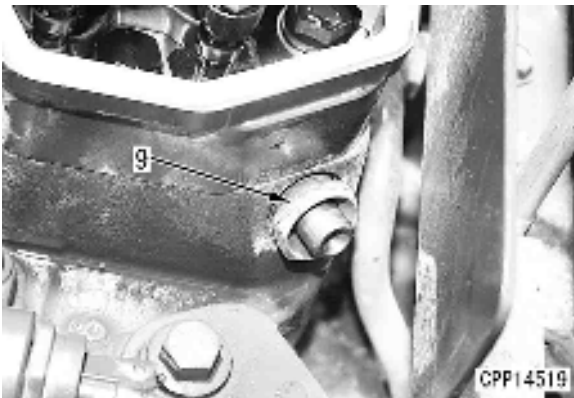
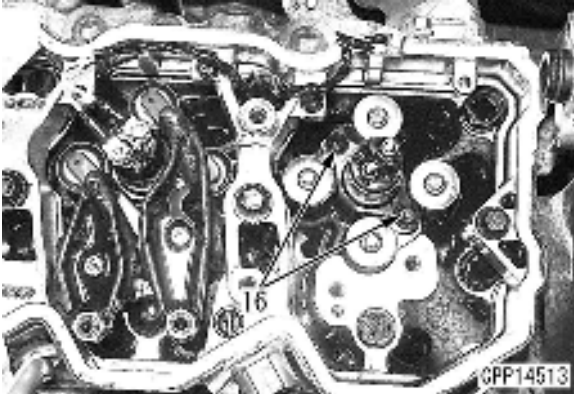
⌚ Fuel injector mounting bolt:

$8 \pm 0.8 \text{ Nm}$ { $0.8 \pm 0.08 \text{ kgm}$ }

- 8) Tighten retaining nut (9) to the specified torque.

⌚ Retaining nut:

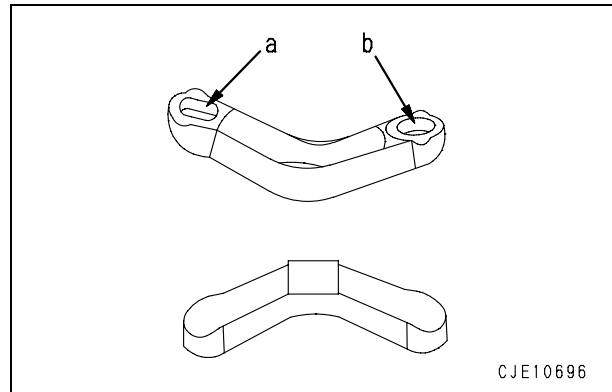
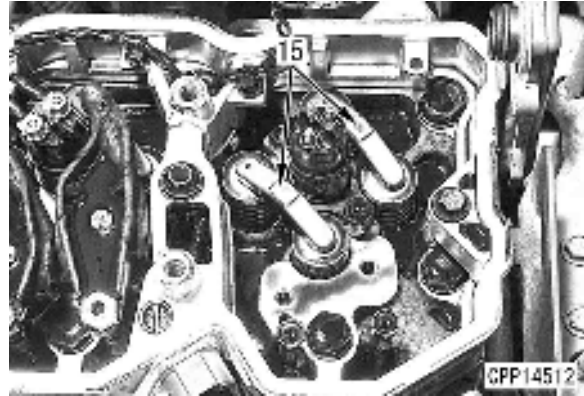
$50 \pm 5 \text{ Nm}$ { $5.1 \pm 0.5 \text{ kgm}$ }



2. Install crosshead (15).

★ Since the shapes of holes [a] and [b] of the crosshead are different, take care when installing.

(Install the crosshead in the direction of the intake and exhaust valves recorded when it was removed.)



3. Install rocker arm (14).

★ Before installing the rocker arm, check that adjustment screw (13) is loosened thoroughly.

★ Check that the ball of the adjustment screw is fitted to the socket of the push rod.

⌚ Rocker arm mounting bolt:

$36 \pm 5 \text{ Nm}$ { $3.7 \pm 0.5 \text{ kgm}$ }

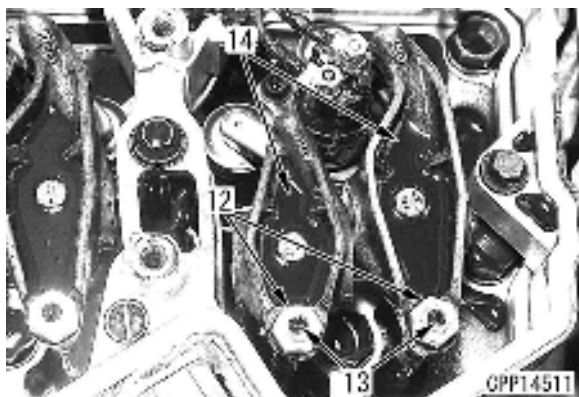
4. Install wiring (11).

- ★ Since different cylinders have different wire colours, check their combinations before installing.
- ★ Installed positions of wiring

Wiring colour	Cylinder No.
White	1, 3
Black	2, 4

⌚ Wiring mounting nut:

$1.5 \pm 0.25 \text{ Nm}$ { $0.15 \pm 0.03 \text{ kgm}$ }



5. Adjusting valve clearance

Referring to Testing and adjusting, "Adjusting valve clearance", adjust the valve clearance.

- Carry out the following installation in the reverse order to removal.

[*1]

⌚ Blow-by duct mounting bolt:

$7 \pm 2 \text{ Nm}$ { $0.7 \pm 0.2 \text{ kgm}$ }

[*2]

- ★ If the stud bolts were removed, tighten them to the following torque.

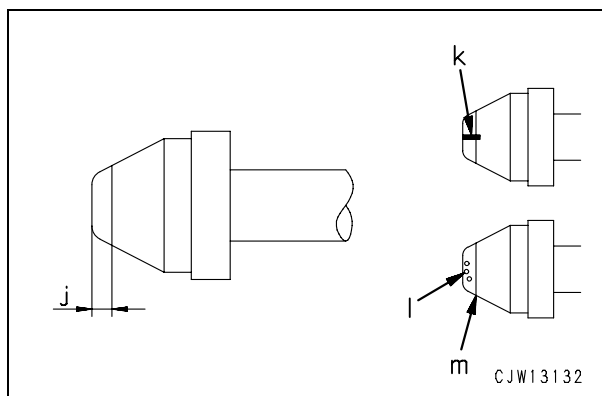
⌚ Stud bolt: **$24 \pm 4 \text{ Nm}$ { $2.4 \pm 0.4 \text{ kgm}$ }**

[*3] • [*4]

- ⚠ Do not bend the high-pressure pipe to collect before installing.
- ⚠ Be sure to use the genuine high-pressure pipe clamps and observe the tightening torque.
- ⚠ After installing the high-pressure pipe, be sure to install the bellows to the sleeve nut.

- ★ Before installing the high-pressure pipe, check it for the following defects. If there is any of these defects, it can cause fuel leakage. Accordingly, replace the high-pressure pipe with new one.

- Check the taper seal of the connecting part (Part "j": Part of 2 mm from the end) for visible lengthwise slit "k" and dent "l".
- Check part "m" (End of the taper seal: Part at 2 mm from the end) for stepped-type wear (fatigue) which your nail can feel.



- Install the high-pressure pipe according to the following procedure.

1. Install the high-pressure pipe and temporarily tighten the sleeve nuts on the common rail side and cylinder head side.

⌚ Sleeve nut:

$0.2 - 0.8 \text{ Nm}$ { $0.02 - 0.08 \text{ kgm}$ }

2. Tighten the sleeve nuts on the common rail side and cylinder head side to the specified torque.

⌚ Sleeve nut:

$35 \pm 3.5 \text{ Nm}$ { $3.57 \pm 0.36 \text{ kgm}$ }

3. Install the sleeve nuts on the common rail side and cylinder head side.

- ★ Install each bellows with the slits out and down.

- ★ The bellows are installed so that fuel will not spout over the hot parts of the engine and catch fire when it leaks for some reason.

- ★ If all of the No. 1 – No. 4 injector assemblies were removed, install the high-pressure pipes, referring to "Removal and installation of cylinder head assembly".

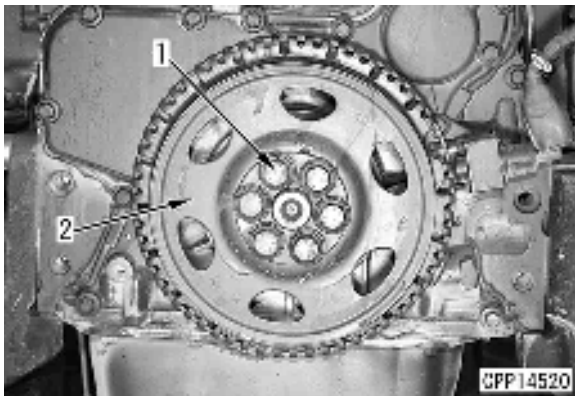
Removal and installation of front oil seal

Special tools

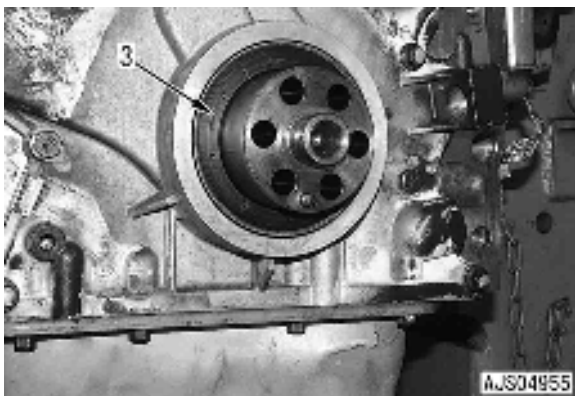
Symbol		Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
A	4	795-799-6400	Seal puller	■	1		
	6	790-331-1120	Wrench (Angle)	●	1		

Removal

1. Remove the engine assembly. For details, see "Removal and installation of engine assembly".
2. Remove crank pulley mounting bolts (1) and crank pulley (2).

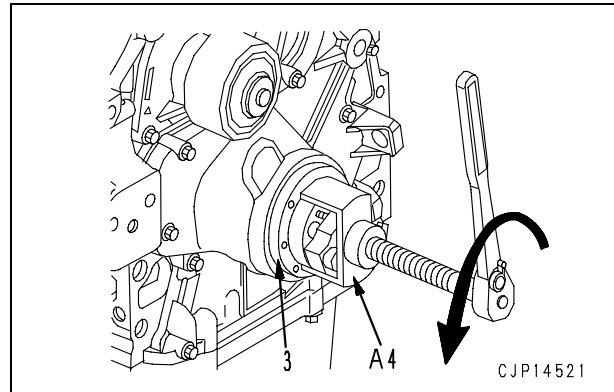


3. Remove seal (3).



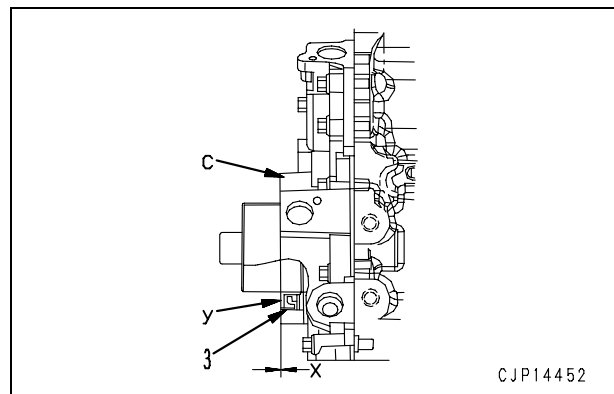
Installation

1. Using tool **A4**, install front oil seal (3).
 - ★ Replace the front oil seal with new one.
 - ★ Before installing the seal, check that the end corners and lip sliding surfaces of the crankshaft are free from flaw, burr, and rust of the housing.
 - ★ When installing the seal, do not apply oil or grease to the shaft and seal lip "a". Wipe off the oil from the shaft.



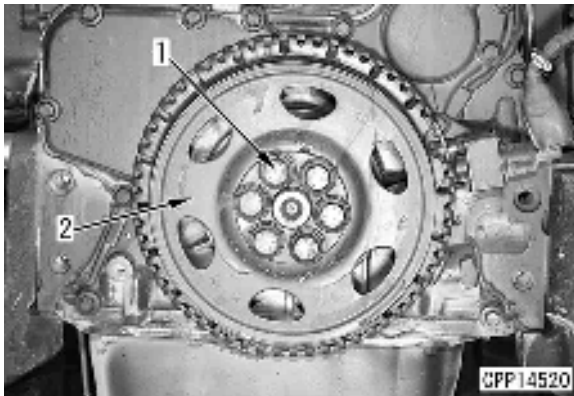
- ★ The projection and runout of seal (3) from cover (C) must be as follows.

- Projection x : Max. 0.38 mm
- Runout y : Max. 0.25 mm

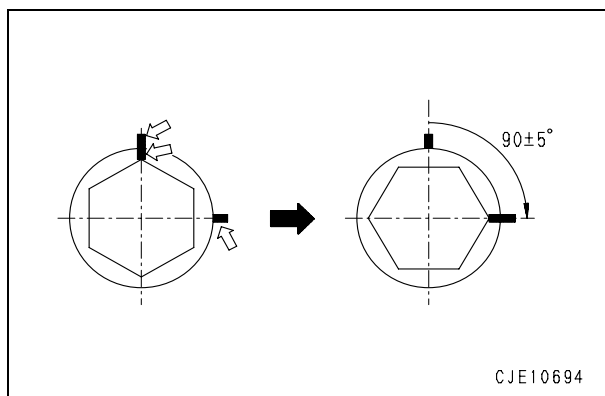


2. Crank pulley

- 1) While checking the dowel pin hole on the back side of the crank pulley (2), install crank pulley (2) to the crankshaft.
 - ★ If the dowel pin was removed, install it before installing the crank pulley.
- 2) Tightening order of crank pulley mounting bolts (1)
 - 1) Tighten the bolts to
 $55 \pm 5 \text{ Nm} \{5.6 \pm 0.5 \text{ kgm}\}$
 in the diagonal order.
 - 2) Loosen the bolts by 180° .
 - 3) Tighten the bolts to
 $55 \pm 5 \text{ Nm} \{5.6 \pm 0.5 \text{ kgm}\}$
 in the diagonal order.
 - 4) Tighten the bolts by
 $90^\circ \pm 5^\circ$
 (with angle tightening tool A6).



- When not using angle tightening tool
 Make a mark on the crank pulley and each bolt with paint and then tighten the bolt by $90^\circ \pm 5^\circ$.



- Carry out the installation in the reverse order to removal.

Removal and installation of rear oil seal

Special tools

Symbol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
A 5	795-799-6500	Seal puller	■	1		

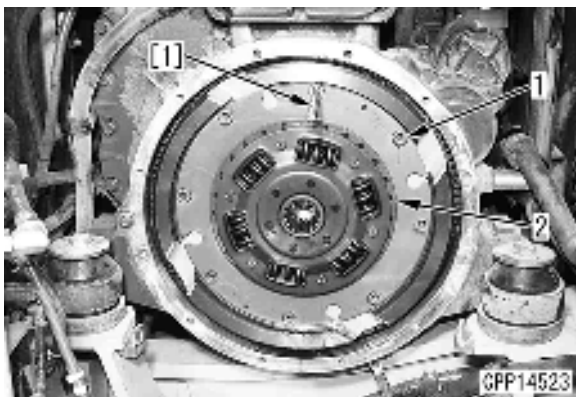
Removal

⚠ Disconnect the cable from the negative (-) terminal of the battery.


1. Remove the work equipment assembly. For details, see "Removal and installation of work equipment assembly".
2. Removal of damper
 - 1) Remove 1 damper mounting bolt (1) at the top.

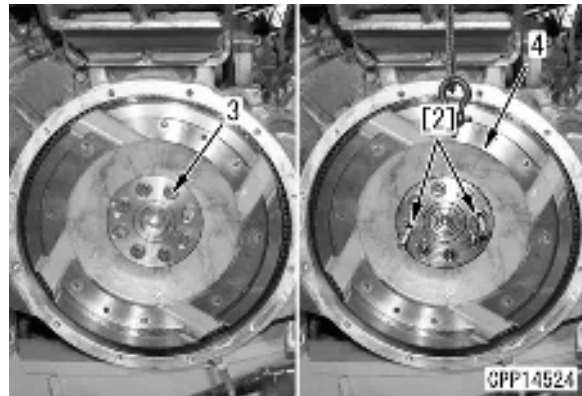


- 2) Install guide bolt [1] and remove the 7 remaining damper mounting bolts (1).
- 3) Remove damper (2).

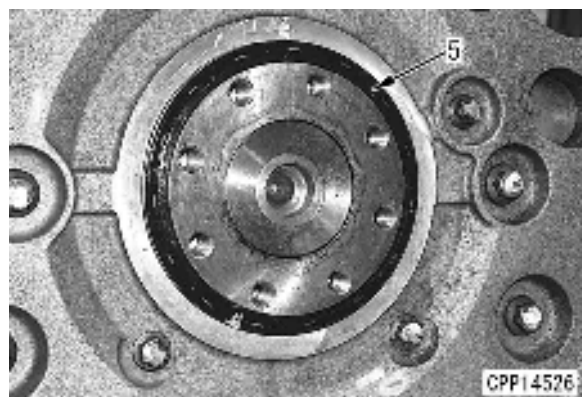
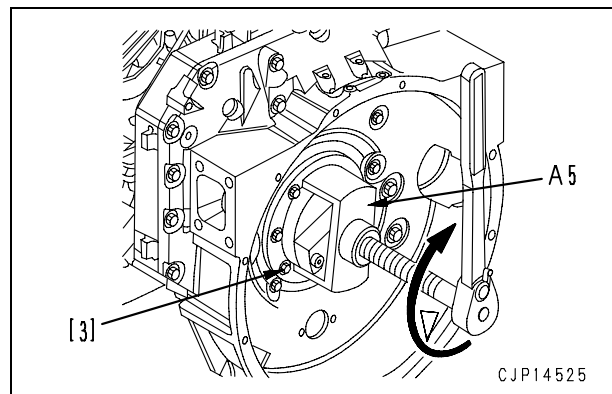


3. Removal of flywheel
 - 1) Remove 2 flywheel mounting bolts (3) on a diagonal line and install guide bolts [2]. [*1]
 - 2) Sling flywheel (4) and remove the remaining mounting bolts.
 - 3) Pull out flywheel (4) toward you.
 - 4) Remove guide bolts [2] and lift off flywheel (4).

 Flywheel: 35 kg

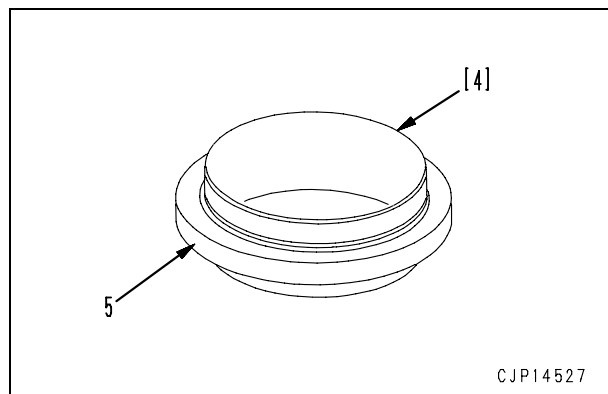


4. Removal of rear oil seal
 - 1) Install tool A5 to the crankshaft.
 - 2) Tighten tapping screw [3] of tool A5 into the seal carrier of rear oil seal (5).
 - 3) Turn the handle clockwise to remove rear oil seal (5).

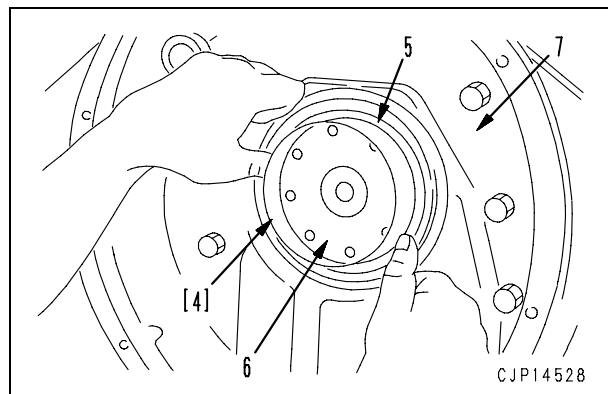


Installation

1. Install the rear seal according to the following procedure.
 - ★ Replace the front oil seal with new one.
 - ★ Do not remove pilot [4] which is attached to rear seal (5) until rear seal (5) is inserted to the crankshaft.
 - ★ Before installing the rear seal, degrease, clean and dry the crankshaft sealing face and the seal lip face to prevent oil leakage.

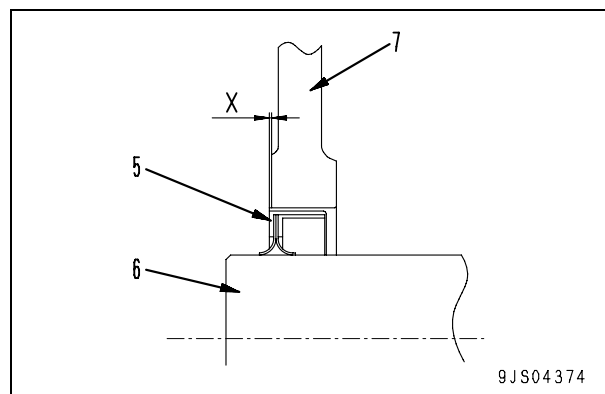
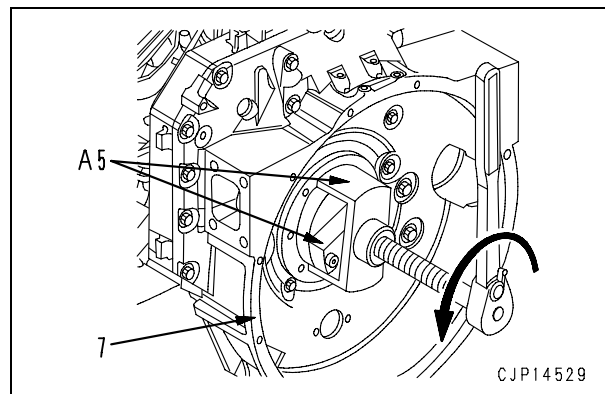


2. Insert pilot [4] to crankshaft (6) and push rear seal (5) into flywheel housing (7).
3. Push in rear seal (5) further and pull out pilot [4].



4. Install rear seal (5) on flywheel housing (7) to the proper depth by using tool A5.

- ★ Push in rear seal (5) taking care that there are no bend etc. on it.
- ★ Extrusion of rear seal (5) from flywheel housing (7)
(X): less than 0.38 mm



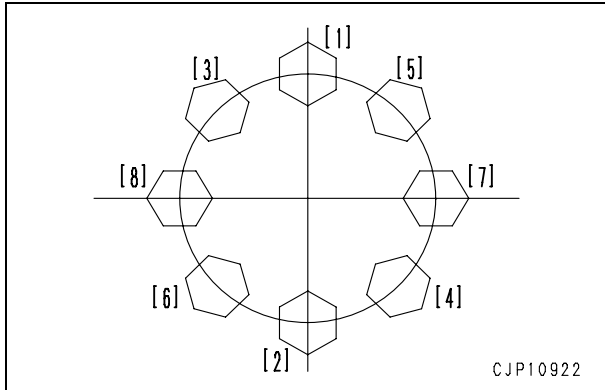
- Carry out the rest of installation in the reverse order to removal.

[*1]

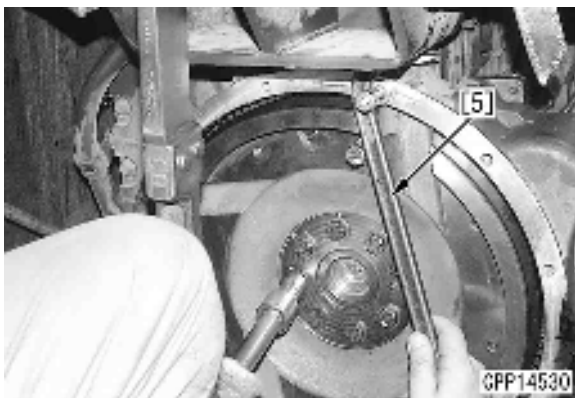
- ★ Tighten the 8 flywheel assembly mounting bolts in the order of [1] through [8] as shown in the figure below.

⌚ Flywheel assembly mounting bolt:

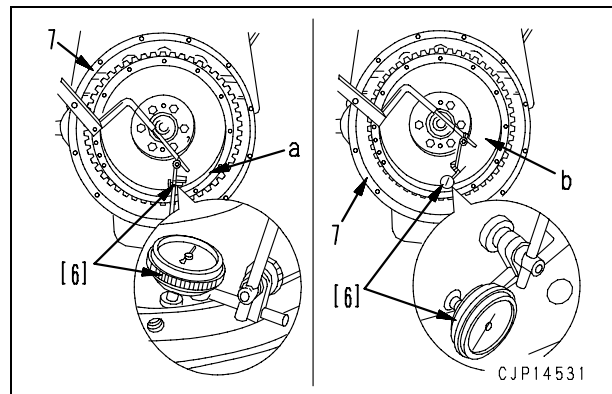
137 ± 7 Nm {13.97 ± 0.71 kgm}



- ★ Tighten the bolts using bar [5] for preventing rotation of the flywheel assembly.



- Measurement of facial runout
 - ★ Facial runout: less than 0.20 mm
 - 4) As in the case of measurement of radial runout, bring the dial gauge probe into contact with end surface (b) near the outer perimeter of the flywheel at a right angle.
 - ★ Conduct measurement pulling the crankshaft to either the front or rear side to prevent errors caused by shakiness.
 - 5) Rotate the flywheel 360 ° and measure the difference of the maximum swing of the dial gauge indicator.



- Measurement of radial runout
 - ★ Radial runout: less than 0.13 mm
 - 1) Set dial gauge [6] to the stand, and set it to flywheel housing (7).
 - 2) Bring the dial gauge probe into contact with facet joint portion (a) or the outer perimeter surface of the flywheel at a right angle.
 - 3) Rotate the flywheel 360 ° and measure the difference of the maximum swing of the dial gauge indicator.
 - ★ Check that the dial gauge indicator is back in the original position after the flywheel is rotated 360 °.

Removal and installation of cylinder head assembly

Special tools

Symbol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
A	1 795-799-6700	Puller	■	1		
	2 795-799-1131	Gear	■	1		
	3 795-799-8150	Remover	●	1		
	6 790-331-1120	Wrench (Angle)	●	1		
	7 795-790-4510	Gauge	●	1		

Removal

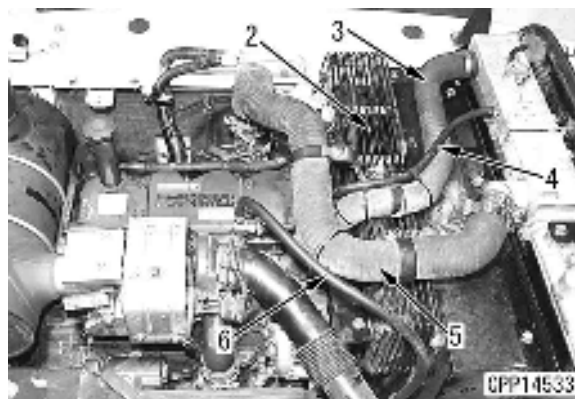
⚠ Disconnect the cable from the negative (–) terminal of the battery.

1. Open the right rear inspection cover and open fuel drain valve (1) to drain the fuel.
When fuel tank is full: **193 ℓ**

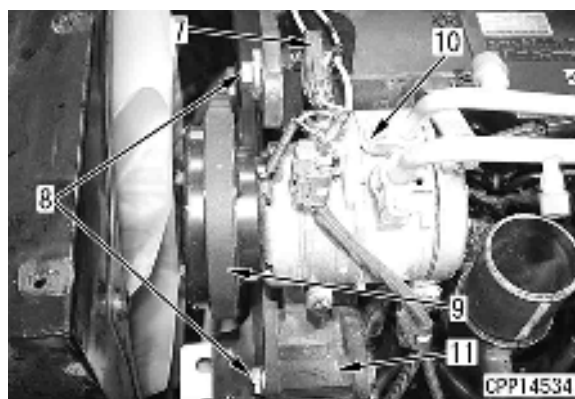


2. Removal of engine hood
Remove the engine hood. For details, see "Removal and installation of engine hood".

3. Removal of hoses and guard above engine
 - 1) Remove air conditioner compressor drive belt guard (2).
 - 2) Remove radiator hose (3). [*1]
 - 3) Remove aeration hose (4).
 - 4) Remove aftercooler hose (5). [*2]
 - 5) Disconnect heater hose (6).

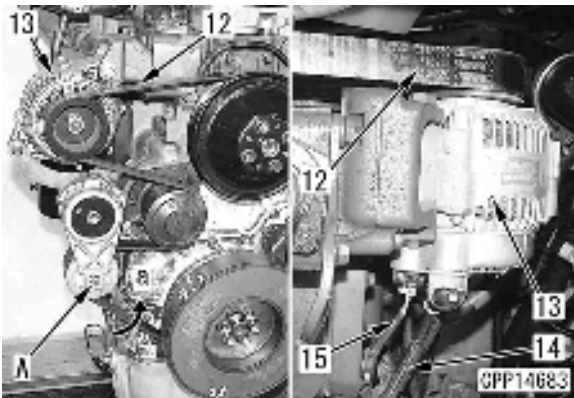


4. Disconnection of air conditioner compressor assembly
 - 1) Disconnect wiring connector A01 (7).
 - 2) Remove 2 air conditioner compressor mounting bolts (8).
 - 3) Remove drive belt (9).
 - 4) Disconnect air conditioner compressor assembly (10) and move it so that it will not be an obstacle.
 - 5) Remove bracket (11).



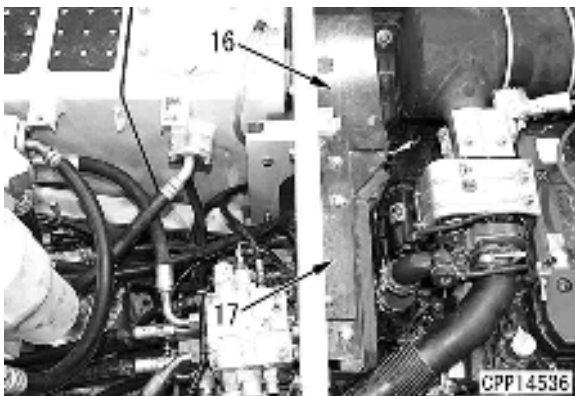
5. Removal of alternator

- 1) Insert the wrench in part A and turn it to the direction of [a] to loosen fan belt (12).
- 2) Remove fan belt (12) from alternator (13).
 - ⚠ **Set the wrench in hole A securely and then turn the tension pulley to direction [a]. (The tension pulley spring is very strong. If the wrench is installed half-way and turned, it may come off and can cause a serious accident.)**
 - ⚠ **After removing the fan belt, return the wrench slowly and carefully.**
 - ⚠ **Take care not to catch your fingers between the pulley and fan belt during the work.**
- 3) Remove the alternator mounting bolts and disconnect alternator assembly (13). (Move the alternator without removing wirings (14) and (15) so that it will not be an obstacle.)

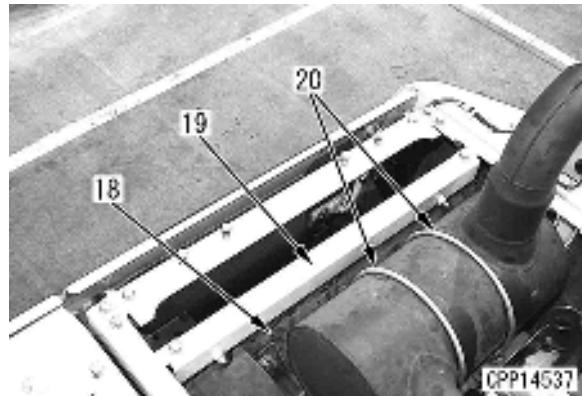


6. Disconnection of muffler and turbocharger assembly

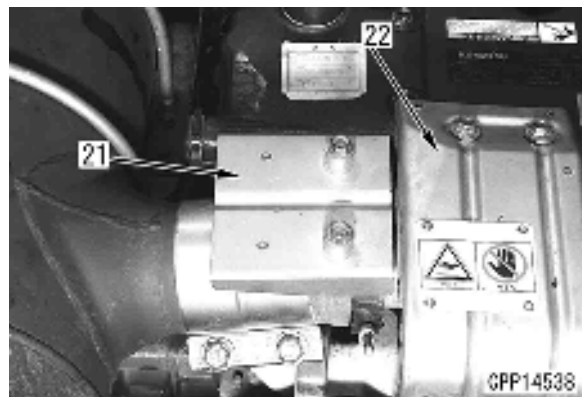
- 1) Remove cover (16).
- 2) Remove cover (17).



- 3) Remove partition (18).
- 4) Remove support (19).
- 5) Loosen 2 U-bands (20).



- 6) Remove clamp top covers (21) and (22).

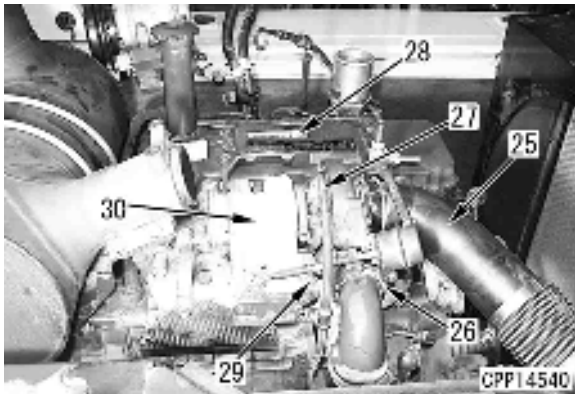


- 7) Remove clamp (23).
- 8) Slant muffler assembly (24) outward.



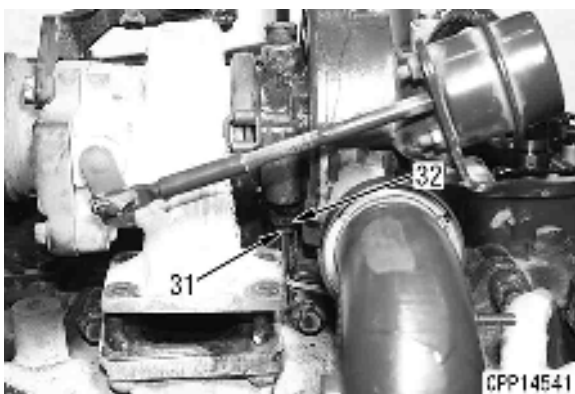
7. Removal of turbocharger assembly and exhaust manifold

- 1) Disconnect hose (25) between the turbocharger and air cleaner from the turbocharger. [*3]
- 2) Loosen the aftercooler lower hose at air connector (26). [*4]
- 3) Disconnect the air intake connector from the turbocharger. [*5]
- 4) Remove lubrication upper hose (27). [*6]
 - ★ Fix the connector mounting nut with a spanner to prevent it from being dragged.
- 5) Remove cylinder head cover (28). [*7]
 - ★ If the cylinder head cover is not removed, the lubrication return tube mounting bolt on the cylinder head side cannot be removed.
- 6) Remove 4 mounting nuts (29) of turbocharger assembly (30) and place turbocharger assembly (30) on the bolts. [*8]
 - ★ If turbocharger assembly (30) is not raised to increase the clearance, the mounting bolts on the inside of the lubrication return tube cannot be removed.

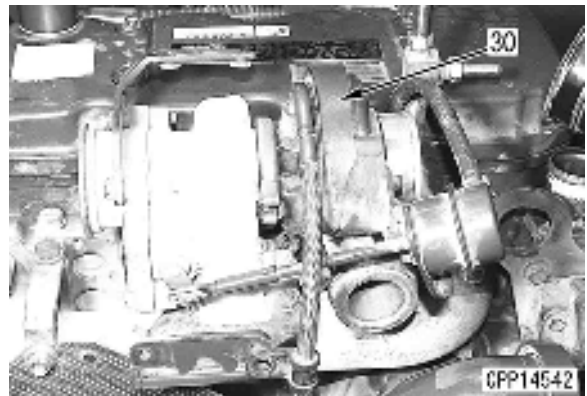


7) Remove 2 lubrication return tube mounting bolts (31) and disconnect lubrication return tube (32). [*9]

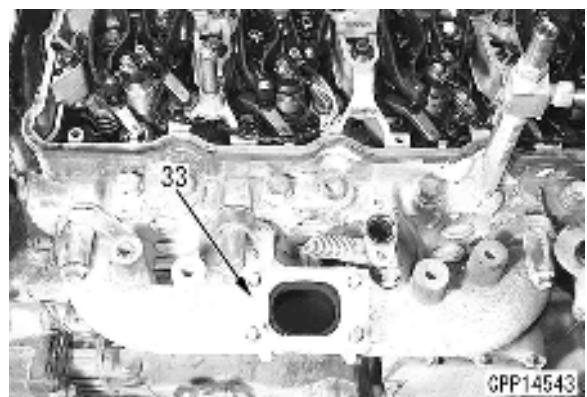
- ★ Mounting bolt:
Hexagon head bolt (M6 × 1.0)



8) Remove turbocharger assembly (30).

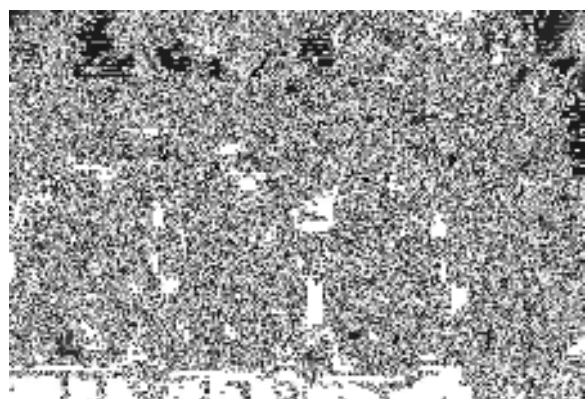


9) Remove exhaust manifold (33). [*10]

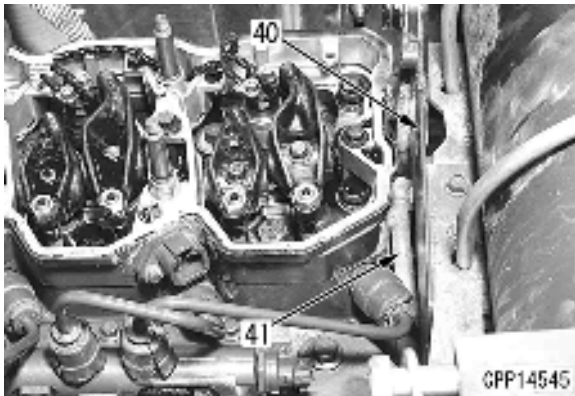


8. Disconnect of wiring

- 1) Disconnect wiring connectors (34) and (36).
- 2) Disconnect wiring clamp mounting brackets (37) and (38).
- 3) Move wiring (39) toward the counter weight side.



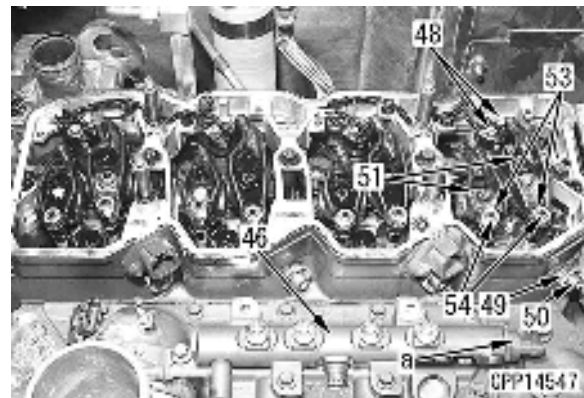
9. Disconnect of fuel return hose
 - 1) Remove partition (40).
 - 2) Disconnect fuel return hose (41).



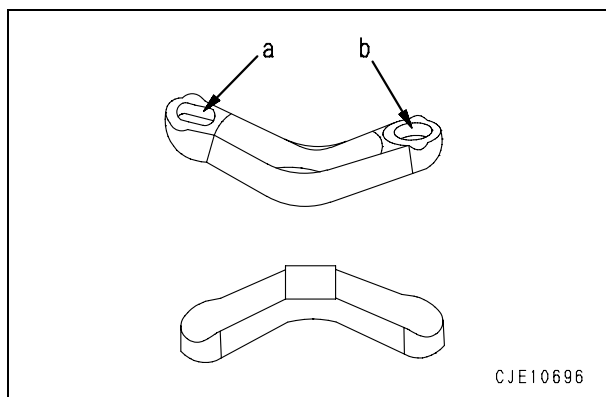
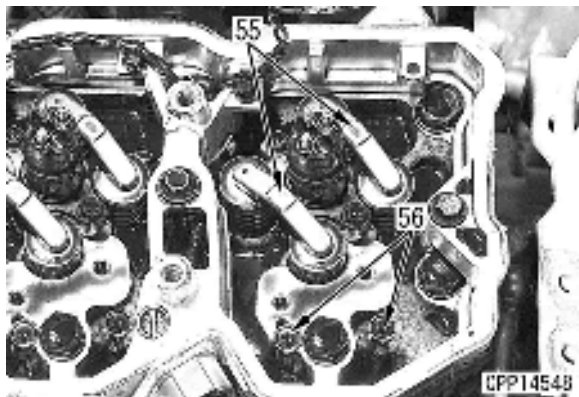
10. Remove oil level gauge guide (42).
11. Removal of fuel high-pressure pipe
 - 1) Remove high-pressure pipe bellows (43) between the common rail and cylinder head and that between the common rail and fuel supply pump. [*11]
 - 2) Remove high-pressure pipe (44) between the common rail and cylinder head.
 - 3) Disconnect high-pressure pipe (45) between the common rail and fuel supply pump from the common rail.
 - ★ Remove 2 high-pressure pipe clamps between the common rail and fuel supply pump and loosen the high-pressure pipe sleeve nut on the supply pump side.



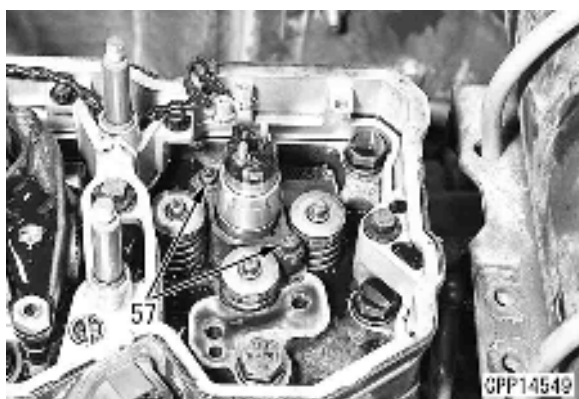
12. Remove common rail (46). [*13]
 - ★ Do not remove fuel pressure sensor (a) for a reason other than replacement.
 - ★ When removing the fuel pressure sensor to replace, remove all mud from and clean around it thoroughly.
13. Referring to Testing and adjusting, "Adjusting valve clearance", check that the No. 1 and 4 cylinders are at the top dead centre.
14. Removal of injector and rocker arm housing
 - 1) Disconnect wiring (48) from the injector. [*14]
 - 2) Loosen retaining nut (49) and remove inlet connector (50). [*15]
 - ★ Tool **A3** is prepared for removal of the inlet connector.
 - 3) Remove rocker arm mounting nuts (51) and rocker arm and its seat. [*16]
 - ★ Loosen lock nut (53) and then loosen adjustment screw (54) thoroughly.



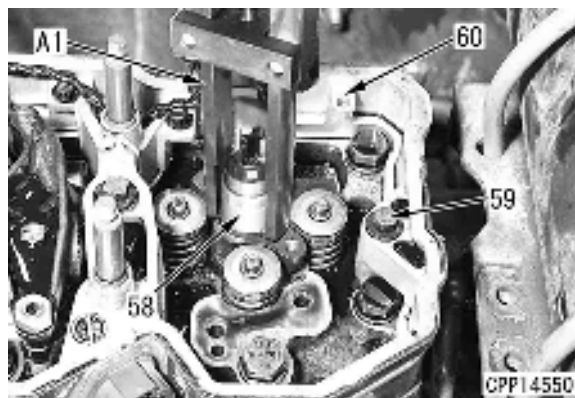
- 4) Remove crosshead (55). [*18]
 - ★ Record the position and direction (shapes of holes "a" and "b") of each crosshead. (When reinstalling the crosshead, set it in the same direction.)
- 5) Remove push rod (56).




- 6) Remove 2 fuel injector assembly mounting bolts (57). [*19]

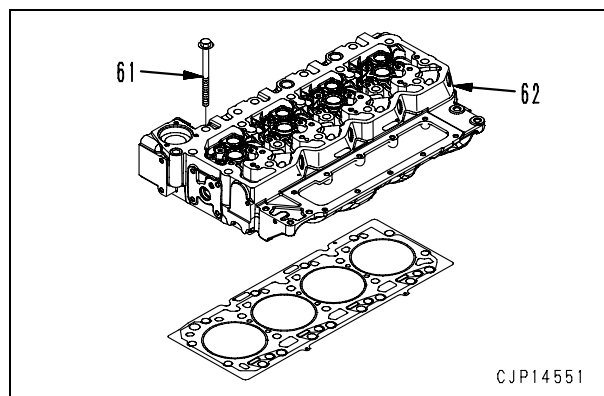


- 7) Using tool A1, remove fuel injector assembly (58). [*20]
- 8) Remove 5 rocker arm housing mounting bolts (59) and rocker arm housing assembly (60). [*21]



15. Remove 18 cylinder head mounting bolts (61) and lift off cylinder head assembly (62). [*22]

 Cylinder head assembly: **50 kg**



Installation

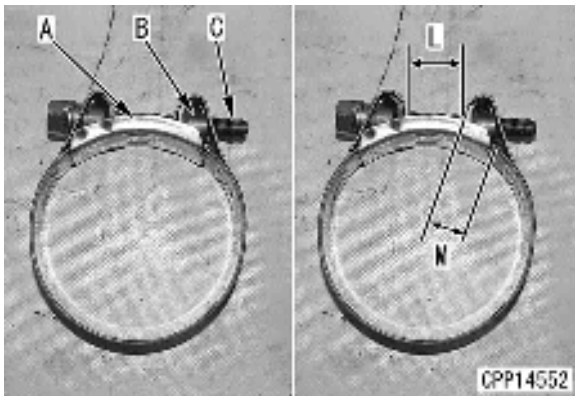
Carry out installation in the reverse order to removal.

[*1]

- ☞ Radiator hose mounting clamp bolt:
10.8 – 11.8 Nm {1.1 – 1.2 kgm}

[*2] [*4]

- ★ Procedure for installing MIKALOR clamp
- When tightening the clamp, apply the following lubricating oil or equivalent to its threaded part [C].
Lubricating oil: Threebond (PANDO 18B)
 - Adjust bridge [A] so that it will be under band [B].
 - Tighten until dimensions [L] and [M] are set to the specified dimensions.
- Dimension L
Between aftercooler and air intake connector:
Aftercooler side: 10 (+0/-3) mm
Air intake connector side:
16 (+0/-3) mm
Between aftercooler and turbocharger connector: 10 (0/-3) mm
- Dimension M: Min. 5 mm
- If the tightened dimensions are out of the above ranges, replace the clamp with new one.
 - Do not use an impact wrench.



[*3]

- ☞ Air hose clamp bolt:
10.0 – 11.0 Nm {1.02 – 1.12 kgm}

[*5]

- ☞ Connector mounting nut:
10 ± 2 Nm {1.02 ± 0.2 kgm}

[*6]

- ☞ Lubrication inlet hose mounting nut:
24 ± 4 Nm {2.4 ± 0.4 kgm}
- ★ When nut on turbocharger side was loosened
- ☞ Nut on turbocharger side:
36 ± 5 Nm {3.7 ± 0.5 kgm}

[*7]

- ★ When stud bolt was removed
- ☞ Stud bolt: **24 ± 4 Nm {2.4 ± 0.4 kgm}**

[*8]

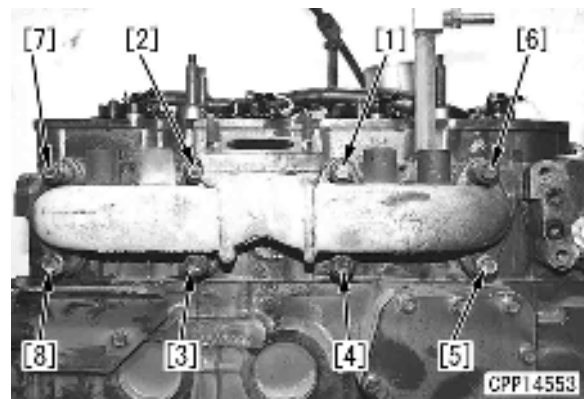
- ☞ Turbocharger mounting nut:
24 ± 4 Nm {2.4 ± 0.4 kgm}
- ★ When stud bolt was removed
- ☞ Stud bolt: **10 ± 2 Nm {1.0 ± 0.2 kgm}**

[*9]

- ☞ Lubrication return hose mounting bolt:
10 ± 2 Nm {1.0 ± 0.2 kgm}

[*10]

- ★ Tighten the exhaust manifold mounting bolts according to the following procedure.
- 1) Tighten the bolts to **24 ± 4 Nm {2.4 ± 0.4 kgm}** in the order shown in the figure.
 - 2) Tighten the bolts to **53 ± 5 Nm {5.4 ± 0.51 kgm}** in the order shown in the figure.
 - 3) Tighten only [1] – [4] in the figure to **53 ± 5 Nm {5.4 ± 0.51 kgm}** again.

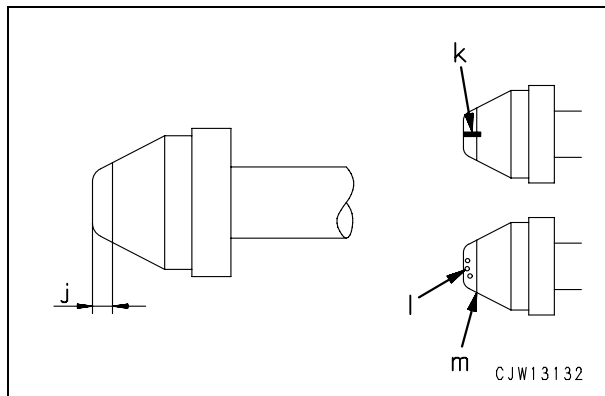


[*11] [*12]

- Precautions for installing high-pressure pipe

- ▲ **Do not bend the high-pressure pipe to collect before installing.**
- ▲ **Be sure to use the genuine high-pressure pipe clamps and observe the tightening torque.**
- ▲ **After installing the high-pressure pipe, be sure to install the bellows to the sleeve nut.**
- ▲ **Direct each bellows out and down.**

- ★ Before installing the high-pressure pipe, check it for the following defects. If there is any of these defects, it can cause fuel leakage. Accordingly, replace the high-pressure pipe.
- Check the taper seal of the connecting part (Part "j": Part of 2 mm from the end) for visible lengthwise slit "k" and dent "l".
- Check part "m" (End of the taper seal: Part at 2 mm from the end) for stepped-type wear (fatigue) which your nail can feel.



- Install the high-pressure pipe according to the following procedure.

(Between common rail and cylinder head)

1. Tighten all the high-pressure pipes temporarily.

☞ Sleeve nut:

0.2 – 0.8 Nm {0.02 – 0.08 kgm}

2. Tighten the high-pressure pipes to the specified torque in the following order.

☞ Sleeve nut:

35 ± 3.5 Nm {3.57 ± 0.36 kgm}

- 1) #1 cylinder head side
- 2) #4 cylinder head side
- 3) #4 common rail side
- 4) #1 common rail side
- 5) #2 cylinder head side
- 6) #3 cylinder head side
- 7) #2 common rail side
- 8) #3 common rail side

(Between common rail and supply pump)

1. Finger-tighten the high-pressure pipes on the supply pump side and common rail side.
2. Tighten the high-pressure pipes to the specified torque in the order of the fuel supply pump side and common rail side.

☞ Sleeve nut:

35 ± 3.5 Nm {3.57 ± 0.36 kgm}

3. Install clamp bracket.

☞ Mounting bolt:

24 ± 4 Nm {2.4 ± 0.4 kgm}

- Install the bellows to all the high-pressure pipe sleeves.

- ★ Install each bellows with the slits out and down.
- ★ The bellows are installed so that fuel will not spout over the hot parts of the engine and catch fire when it leaks for some reason.

[*13]

- Handling of fuel pressure sensor and relief valve

1. Procedure for installing fuel pressure sensor
If the sensor was removed from the common rail, be sure to replace it with new one.

- 1) Check the sensor connector for cracking/breakage, damage of seal, foreign matter at pin, corrosion/bend/breakage of pin, etc.

- 2) Install a new sensor.

- ★ Apply clean gear oil #90 to the threaded part.

Tightening torque:

70 ± 5 Nm {7.1 ± 0.5 kgm}

- 3) Connect the wiring connector. At this time, take care not to connect the connector in reverse.

(After starting the engine, check for leakage. For the checking procedure, see "Shop Manual, Testing and adjusting".)

2. Procedure for installing relief valve

- 1) If the leakage through the relief valve exceeds the specified value, do not reuse that relief valve.

- 2) Install the relief valve.

- ★ Apply clean gear oil #90 to the threaded part.


Tightening torque:

100 ± 4 Nm {10.2 ± 0.4 kgm}

- ★ Tightening too strongly can cause leakage.

(After starting the engine, check for leakage. For the checking procedure, see "Shop Manual, Testing and adjusting".)

[*14]

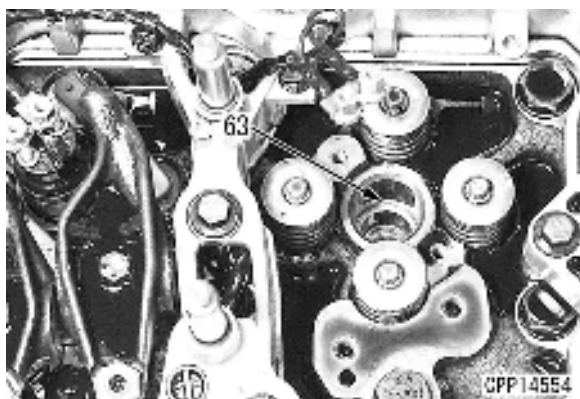
 Wiring mounting bolt:
 $1.5 \pm 0.25 \text{ Nm } \{0.15 \pm 0.03 \text{ kgm}\}$

- ★ Connect the wirings to their original cylinders.

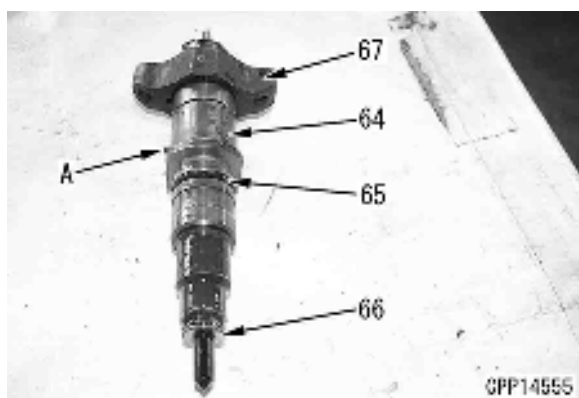
Wiring colour	Cylinder No.
White	1, 3
Black	2, 4

[*15] [*19] [*20]

- Procedure for installing fuel injector
 - ★ Check that fuel injector sleeve (63) is free from flaw and dirt.

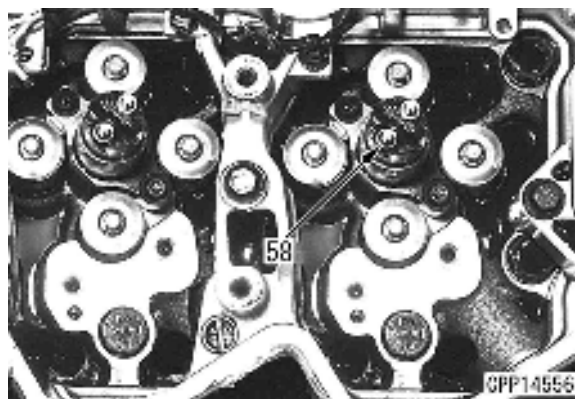


- 1) Fit O-ring (65) and gasket (66) to fuel injector (64).
 - ★ Replace O-ring and gasket with new one.
- 2) Apply engine oil (EO15W-40) to the O-ring of the fuel injector (64) and the mounting hole on the head.
- 3) While setting the concave and convex (A), install holder (67) to fuel injector (64).

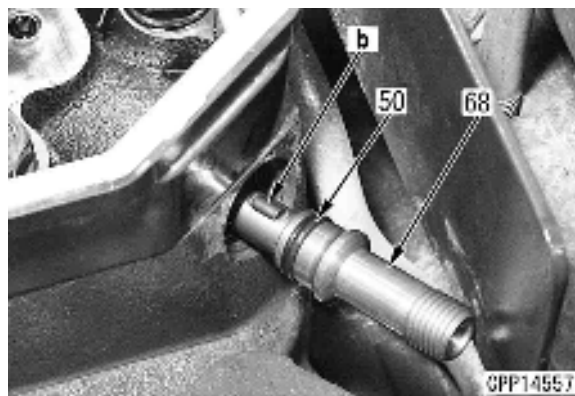


- 4) Install fuel injector assembly (58) to the fuel injector sleeve and tighten the mounting bolt by 3 – 4 turns.

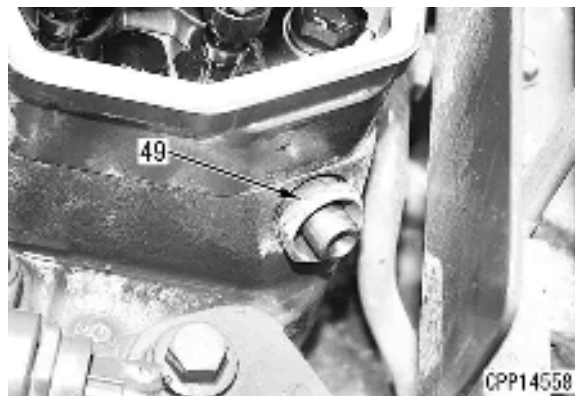
- ★ When installing the fuel injector assembly, direct the fuel inlet hole (inlet connector mounting hole) toward the air intake manifold.



- 5) Apply engine oil (EO15W-40) to O-ring (68) of inlet connector (50) and the inlet connector mounting hole.
- 6) While setting part b of the inlet connector to the groove (upper side) on the head, insert inlet connector (68) to the end.



- 7) Install and finger-tighten retaining nut (49).



- 8) Tighten right and left mounting bolts (57) of injector assembly (58) alternately.

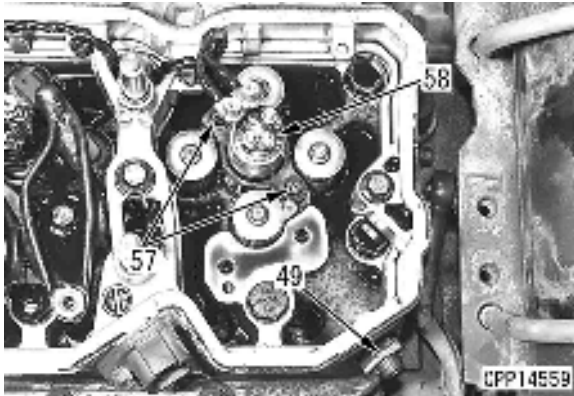
☞ Fuel injector mounting bolt:

$8 \pm 0.8 \text{ Nm}$ { $0.8 \pm 0.08 \text{ kgm}$ }

- 9) Tighten retaining nut (49) to the specified torque.

☞ Retaining nut:

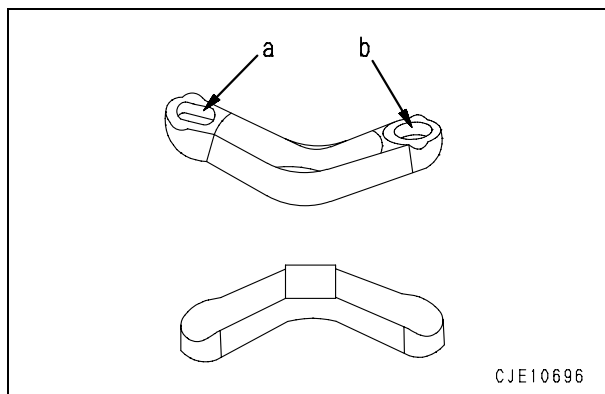
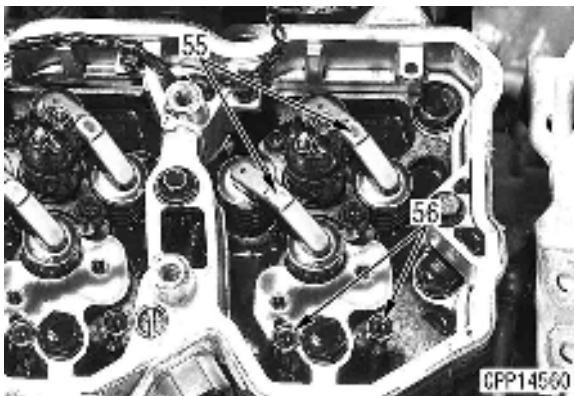
$50 \pm 5 \text{ Nm}$ { $5.1 \pm 0.5 \text{ kgm}$ }



[*16] [*17] [*18]

- Installation of rocker arm
 - 1) Install push rod (56).
 - 2) Install crosshead (55).

★ Install the crosshead to the position in the direction recorded when it was removed (Check the shapes of holes "a" and "b").

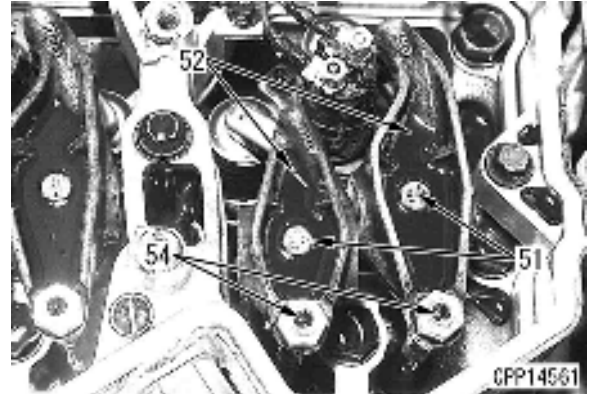


- 3) Install rocker arm (52) and tighten the mounting nut (51).

★ Check that adjustment screw (54) is loosened thoroughly.

☞ Rocker arm mounting bolt:

$36 \pm 5 \text{ Nm}$ { $3.7 \pm 0.51 \text{ kgm}$ }



- Adjusting valve clearance
Referring to Testing and adjusting, "Adjusting valve clearance", adjust the valve clearance.

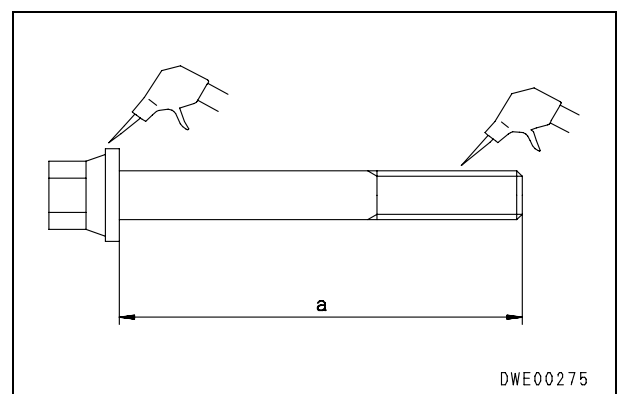
[*21]

☞ Rocker arm housing mounting bolt:

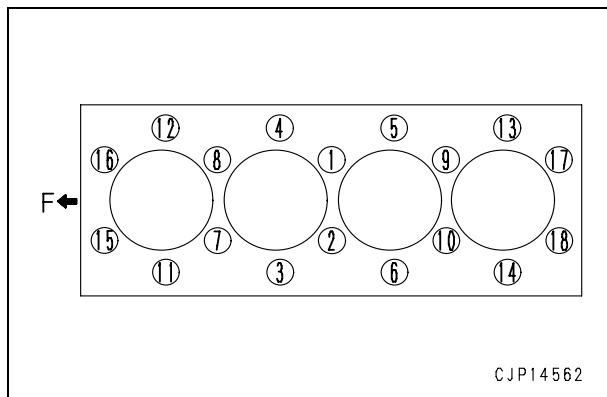
$24 \pm 4 \text{ Nm}$ { $2.4 \pm 0.4 \text{ kgm}$ }

[*22]

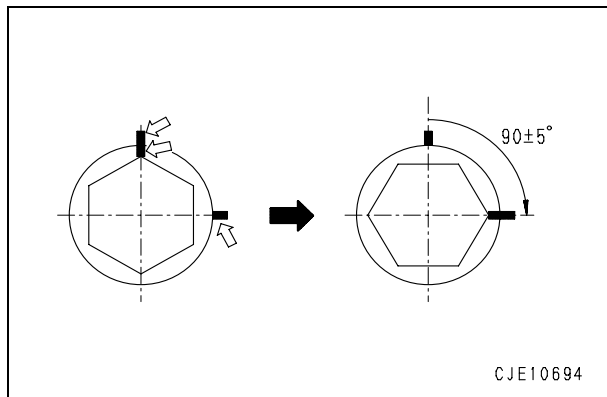
- Precautions for installing cylinder head assembly
 - ★ Use a new gasket.
 - ★ Measure stem length "a" of every bolt and check that it is less than the using limit. Using limit length of bolt stem: 132.1 mm
 - ★ If the stem length of a bolt is longer than the using limit, do not reuse that bolt but replace it.
 - ★ Tool A7 (Gauge) is prepared for measurement of the stem length of the bolts.



- Tighten each cylinder head mounting bolt 2 – 3 turns with the fingers first and then tighten them in the following order.
 - ★ Apply engine oil (SAE15W-40) to the threaded part of each bolt.
 - 1) Tighten the bolts to $70 \pm 6 \text{ Nm}$ $\{7.14 \pm 0.61 \text{ kgm}\}$ in the order of 1 – 18.
 - 2) Loosen all the bolts by $360 \pm 5^\circ$.
 - 3) Tighten the bolts to $105 \pm 3 \text{ Nm}$ $\{110.7 \pm 0.31 \text{ kgm}\}$ in the order of 1 – 18.
 - 4) Tighten the bolts by $90 \pm 5^\circ$ in the order of 1 – 18.
 - ★ **Tool A6 (wrench) is prepared for angle tightening.**



- When not using angle tightening tool
Make a mark on the cylinder head and each bolt with paint and then tighten the bolt by $90^\circ \pm 5^\circ$ in the order of 1 – 18.

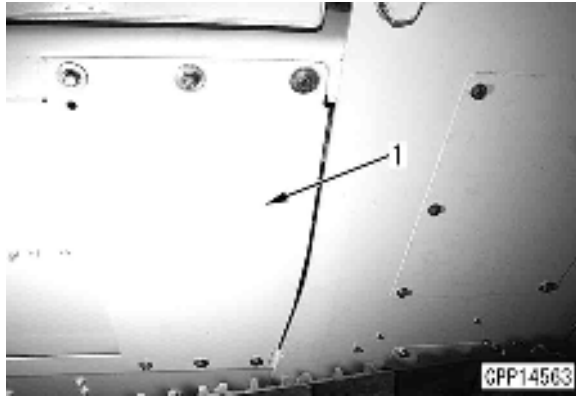


Removal and installation of radiator assembly

Removal

- ⚠ **Disconnect the cable from the negative (–) terminal of the battery.**

1. Remove undercover (1).



2. Open coolant drain valve (2) to drain the coolant.

 Coolant: **18.5 l**

3. Remove 2 mounting bolts (4) of plate (3) and remove the cover.

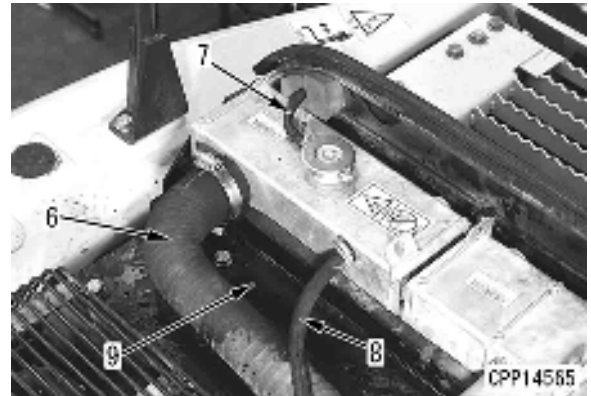
4. Disconnect radiator hose (5).



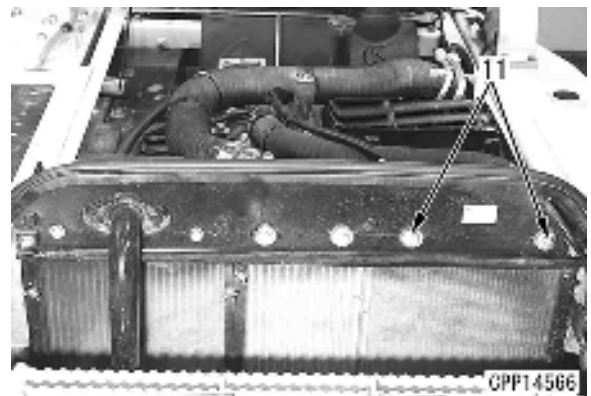
5. Disconnect radiator inlet hose (6). [*1]

6. Disconnect radiator overflow hose (7) and aeration hose (8).


7. Remove 3 mounting bolts (10) of plate (9) and move plate (9) toward the engine.



8. Remove 2 radiator mounting bolts (11). [*2]



9. Lift off radiator assembly (12). [*3]

 Radiator assembly: **20 kg**



Installation

- Carry out installation in the reverse order to removal.

[*1]

- ☞ Radiator hose clamp bolt:
10.8 – 11.8 Nm {1.1 – 1.2 kgm}

[*2]

- ☞ Radiator mounting bolts:
34.2 – 53.8 Nm {3.5 – 5.5 kgm}

[*3]

- ★ When installing, set convex part [a] at the bottom of the radiator assembly to concave part [b] of the chassis.

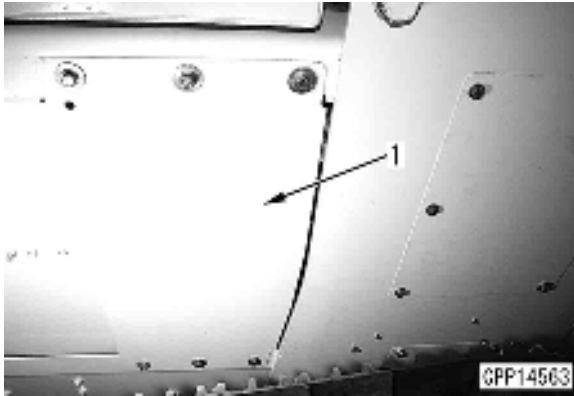


Removal and installation of aftercooler assembly

Removal

- ⚠ **Disconnect the cable from the negative (-) terminal of the battery.**

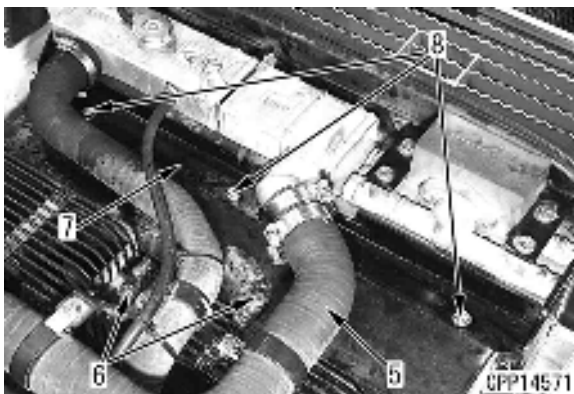
1. Remove undercover (1).



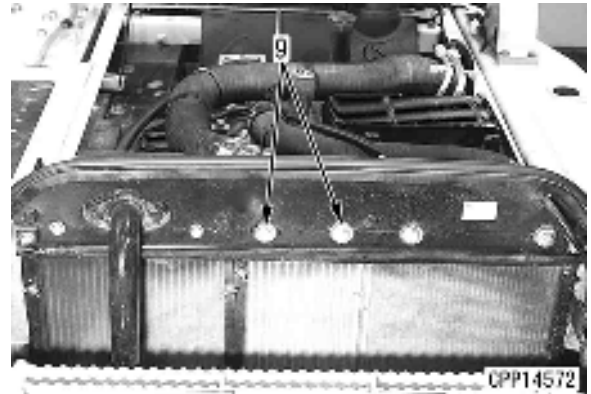
2. Disconnect air aftercooler outlet tube (2).
3. Remove 2 mounting bolts (4) of plate (3) and remove the plate.



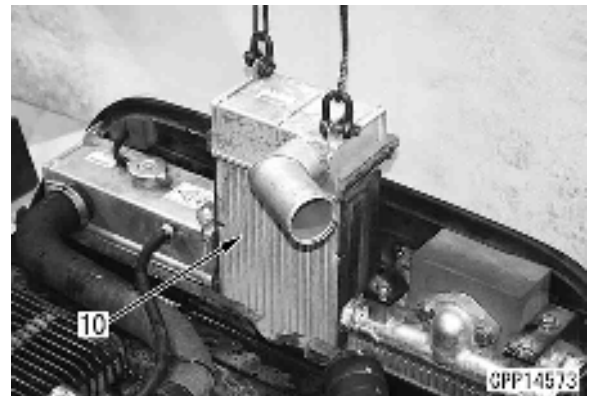
4. Disconnect air aftercooler inlet hose (5) and clamp (6). [*1]
5. Remove 3 mounting bolts (8) of plate (7) and move plate (7) toward the engine.



6. Remove 2 air aftercooler mounting bolts (9). [*2]



7. Lift off air aftercooler assembly (10). [*3]
★ Take care not to damage the sponge on the side.

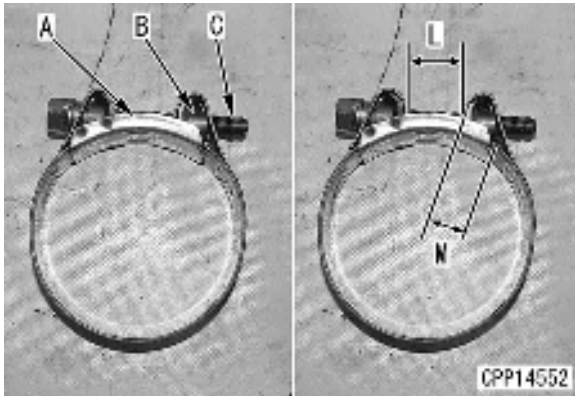


Installation

Carry out installation in the reverse order to removal.

[*1]

- ★ Procedure for installing MIKALOR clamp
 - When tightening the clamp, apply the following lubricating oil or equivalent to its threaded part [C].
Lubricating oil: Threebond (PANDO 18B)
 - Adjust bridge [A] so that it will be under band [B].
 - Tighten until dimensions [L] and [M] are set to the specified dimensions.
Dimension L: 10 (+0/-3) mm
Dimension M: Min. 5 mm
 - If the tightened dimensions are out of the above ranges, replace the clamp with new one.
 - Do not use an impact wrench.

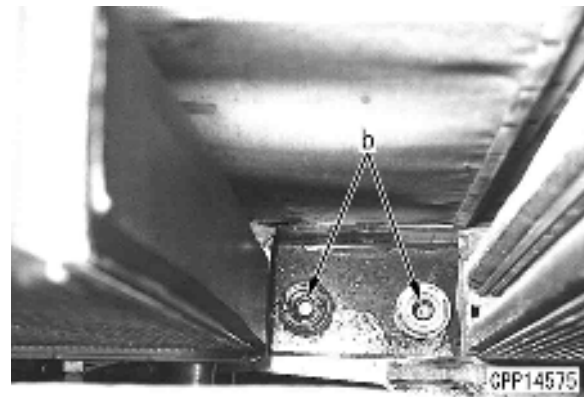
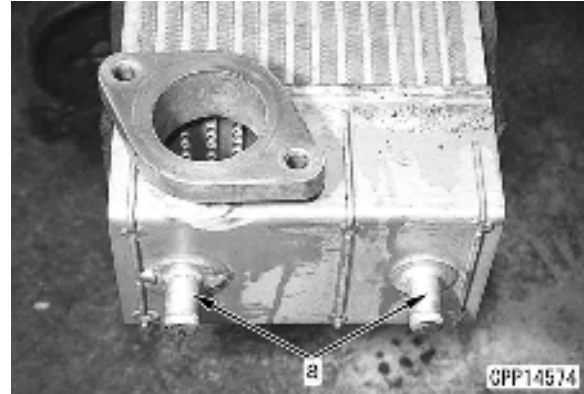


[*2]

- ☞ Aftercooler mounting bolts:
34.2 – 53.8 Nm {3.5 – 5.5 kgm}

[*3]

- ★ When installing, take care not to damage the sponge on the side.
- ★ When installing, set convex part [a] at the bottom of the air aftercooler to concave part [b] of the chassis.



Removal and installation of work equipment oil cooler assembly

Special tools

Symbol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
D	796-460-1210	Oil stopper	●	1		
	796-770-1320	Adapter	●	1		

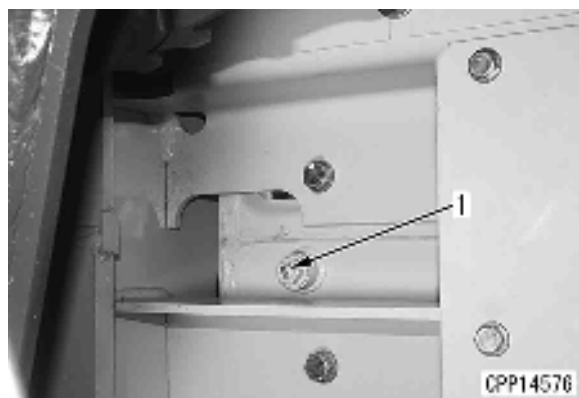
Removal

- ⚠ Stop the machine on a level ground, lower the work equipment to the ground, stop the engine, and set the lock lever in the lock position.
- ⚠ Disconnect the cable from the negative (–) terminal of the battery.
- ⚠ Loosen the hydraulic tank cap gradually to release the residual pressure in the hydraulic tank.

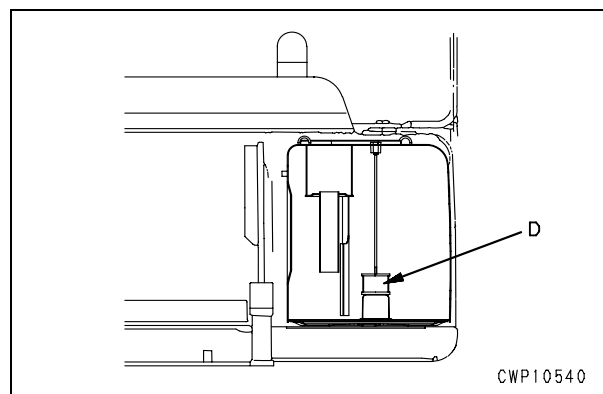
- ★ Put tags to the disconnected piping to prevent a mistake in re-connecting them.

1. Loosen hydraulic oil drain plug (1) to drain the work equipment oil. [*1]

 Hydraulic tank: 167 ℓ



- ★ When using tool D, remove the hydraulic tank strainer and stop the oil with tool D.

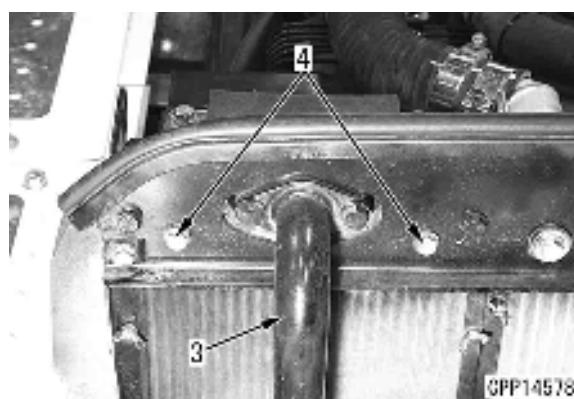


2. Disconnect work equipment oil cooler outlet tube (2). [*2]




3. Disconnect work equipment oil cooler inlet tube (3). [*3]

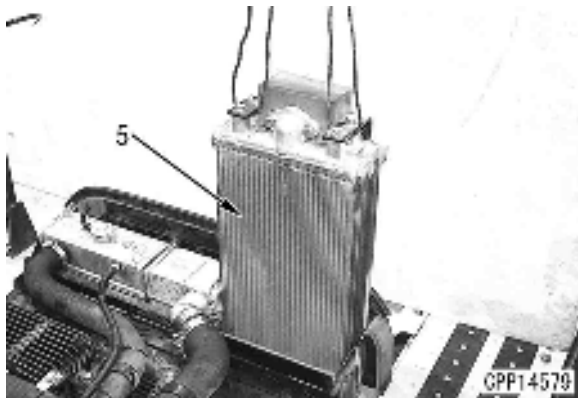
4. Remove 2 work equipment oil cooler mounting bolts (4).



8. Lift off work equipment oil cooler assembly (5).

[*4]

 Work equipment oil cooler assembly:
20 kg



Installation


- Carry out installation in the reverse order to removal.

[*1]

Hydraulic oil drain plug:

58.8 – 78.5 Nm {6.0 – 8.0 kgm}

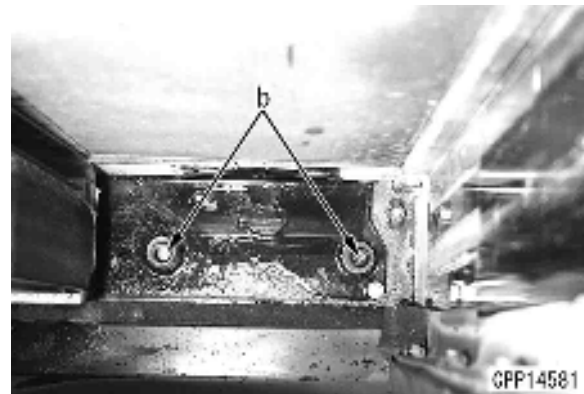
[*2] [*3]

 Oil cooler mounting bolts:

58.8 – 88.5 Nm {6.0 – 9.0 kgm}

[*4]

- ★ When installing, set convex part [a] at the bottom of the work equipment oil cooler assembly to concave part [b] of the chassis.



Removal and installation of engine and hydraulic pump assembly

Special tools

Symbol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
D	796-460-1210	Oil stopper	●	1		
	796-770-1320	Adapter	●	1		

Removal

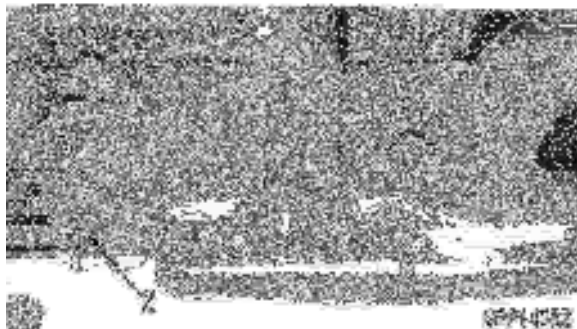
- ⚠ Stop the machine on a level ground, lower the work equipment to the ground, stop the engine, and set the lock lever in the lock position.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.
- ⚠ Loosen the hydraulic tank cap gradually to release the residual pressure in the hydraulic tank.

1. Remove undercover (1).

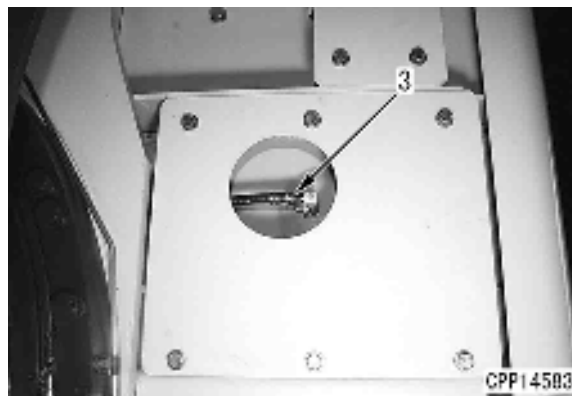


2. Drain the coolant through coolant drain port (2).

⚠ Coolant: 18.5 ℓ



3. Close fuel drain valve (3).

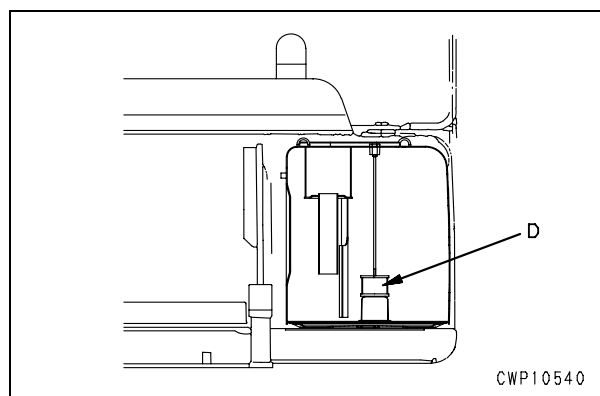


4. Loosen hydraulic oil drain plug (4) to drain the work equipment oil. [*1]

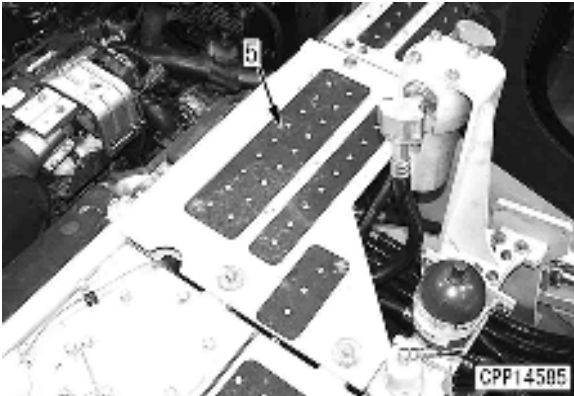
⚠ Hydraulic tank: 167 ℓ



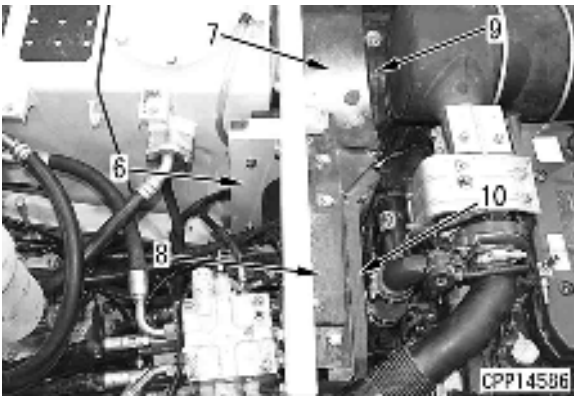
- ★ When using tool D, remove the hydraulic tank strainer and stop the oil with tool D.



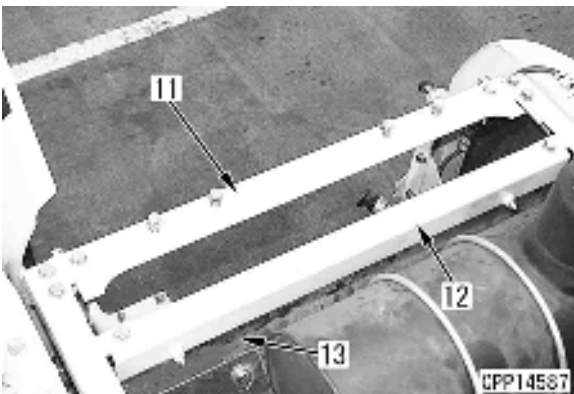
5. Remove the engine hood. For details, see "Removal and installation of engine hood".
6. Removal of covers
 - 1) Remove cover (5).



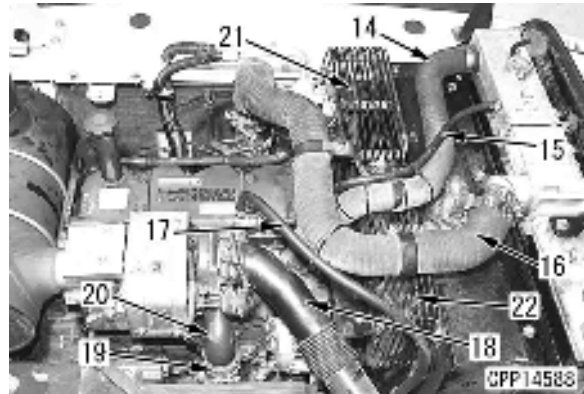
- 2) Remove plate (6).
- 3) Remove covers (7) and (8).
- 4) Remove seat (9).
- 5) Remove partition (10).



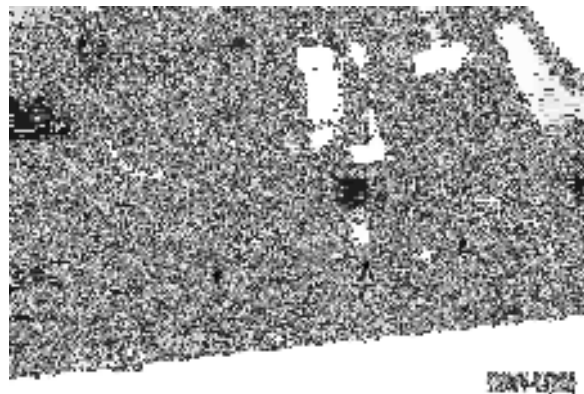
- 6) Remove plates (11) and (12).
- 7) Remove cover (13).



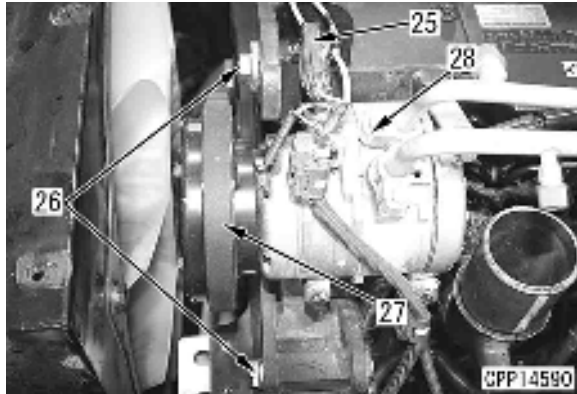
7. Removal of hoses
 - 1) Remove radiator hose (14) and aeration hose (15). [*2]
 - 2) Remove aftercooler hose (16). [*3]
 - 3) Disconnect heater hose (17).
 - 4) Disconnect air hose (18) between the turbocharger and air cleaner. [*4]
 - 5) Disconnect hose (19) between the turbocharger and aftercooler from connector (20). [*5]
 - 6) Remove guard (22).



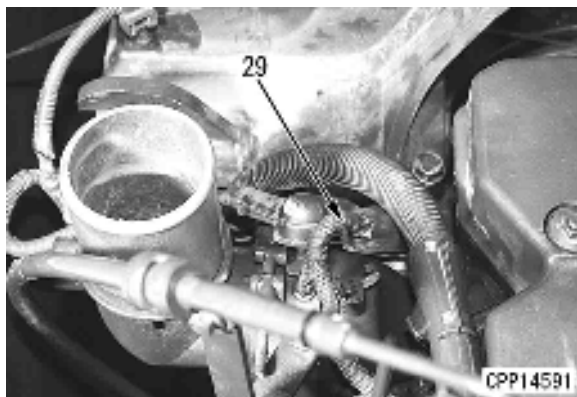
- 7) Disconnect radiator lower hose (23) and heater lower hose (24). [*6]



8. Disconnection of air conditioner compressor assembly
 - 1) Disconnect wiring connector A02 (25).
 - 2) Remove 2 air conditioner compressor mounting bolts (26).
 - 3) Remove drive belt (27).
 - 4) Disconnect air conditioner compressor assembly (28) and move it aside so that it will not be an obstacle. [*7]



9. Disconnect electrical intake air heater wiring terminal E01 (29) from the air intake connector.



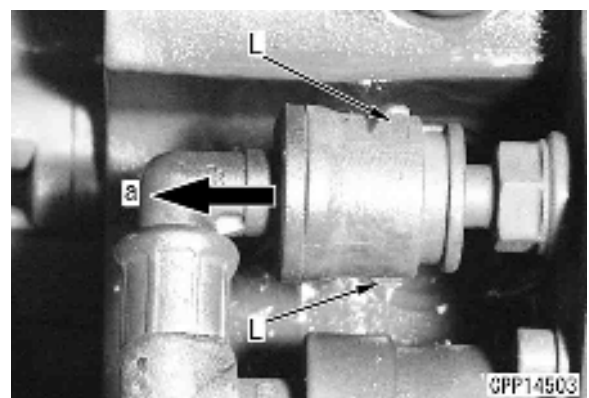
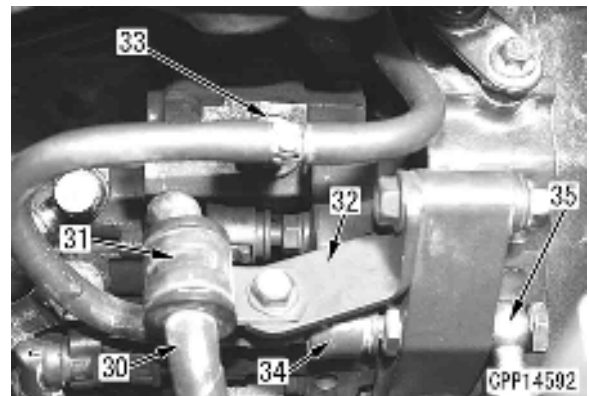
10. Disconnection of fuel supply pump hose and clamp

- 1) Disconnect clamp (31) of fuel hose (30) from bracket (32).
- ★ When loosening the bolt, fix the nut with wrench so that the hose will not be twisted.
(If the hose is dragged and twisted, an excessive force is applied to the connector and the inside of the connector may be broken.)
- 2) Remove clamp bracket (32).
- 3) Disconnect fuel return hose (33) connected to the supply pump. [*8]

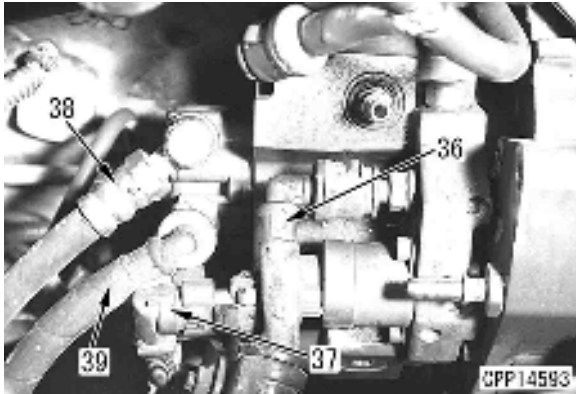
- ★ When removing a connector of quick coupler type, observe the following points.

- Remove mud from each hose joint in advance (since the lock may be stuck in the mud).
- Never use pliers or a screwdriver to disconnect the connector.
- Pull out lock (L) of each hose joint straight (in direction [a]) while pressing it from both sides.
(If the connector is disconnected forcibly by twisting or bending it to the right and left, its inside may be broken.)
- Put plugs in the adapters of the disconnected hoses to prevent fuel from flowing out.
(Do not use wooden plugs since chips may enter the fuel line.)

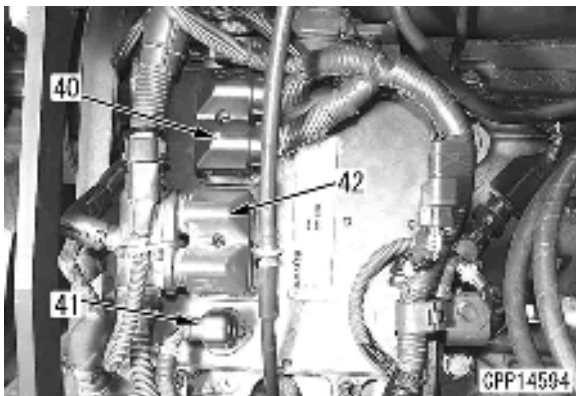
- 4) Disconnect fuel return hose (34).
- 5) Disconnect hose (35) connected to the fuel cooler.



- 6) Disconnect hose (36) connected to the fuel filter.
- ★ Before disconnecting hose (36), be sure to perform steps 1 to 5.
- 7) Disconnect wiring connector (37).
- 8) Disconnect hose (38) connected to the prefilter.
- 9) Disconnect hose (39) connected to the fuel filter.



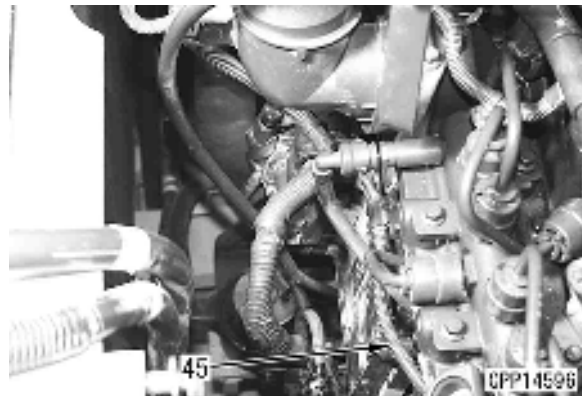
11. Disconnect wiring connectors CE02 (40) and CE03 (41) of the engine controller.
- ★ Do not disconnect ECM connector (42) but leave it connected, since it is on the engine side.



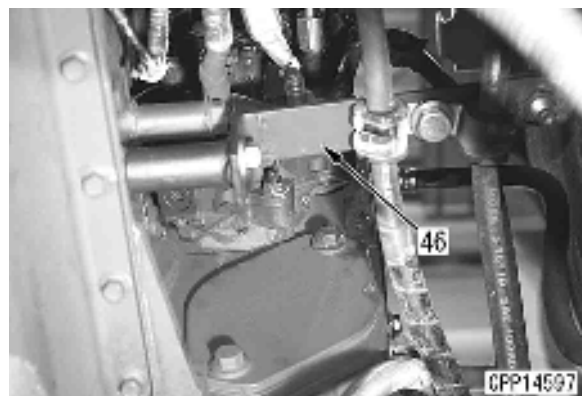
12. Disconnection of starting motor wiring
 - 1) Disconnect starting motor terminal B wiring SB (43).
 - 2) Disconnect starting motor wiring connector E10 (44).
 - ★ Pull connector (45) out of bracket [a] and disconnect the male and female pieces.



13. Disconnect water separator sensor wiring connector E06 (45).
- ★ The wiring connector No. on the engine side is WIF (female).



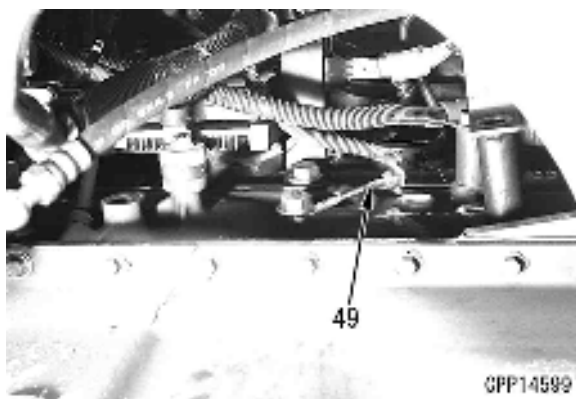
14. Disconnection of wiring from under chassis
 - 1) Disconnect fuel hose clamp bracket (46) from the engine block.



- 2) Disconnect alternator wiring E08 (47) and clamp (48).

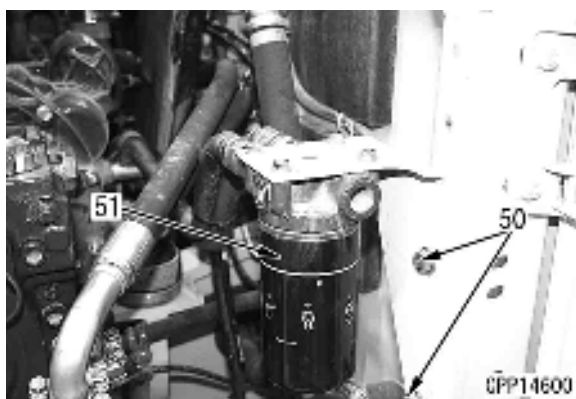


- 3) Disconnect ground wire (49).



15. Remove 2 bolts (50) and disconnect engine oil filter and bracket assembly (51).

★ Fix the assembly to the engine.



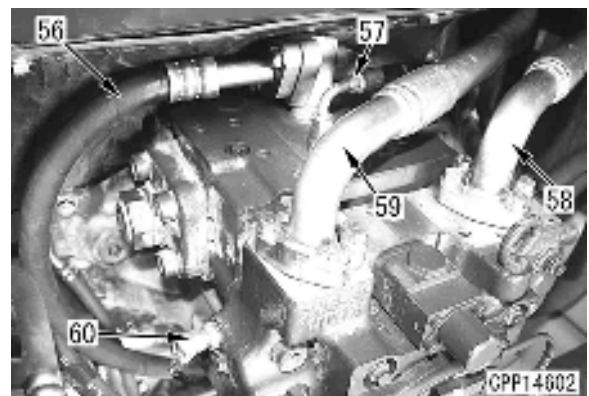
16. Removal of wirings and hoses around hydraulic pump

- 1) Disconnect wiring connectors P22 (52) and V11 (53).
- 2) Disconnect hose (54).
- 3) Disconnect suction tube (55).

★ When disconnecting the hose, place a receiving pan under the pump.



- 4) Disconnect hoses (56), (57), (58), (59) and (60).



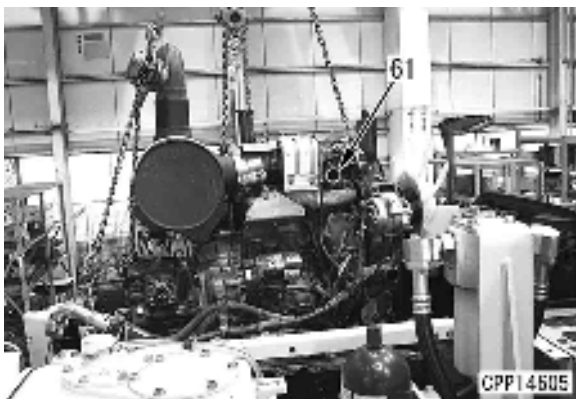
17. Sling engine and hydraulic pump assembly (61) and remove 4 mounting bolts (62). [*9] (Left of engine side) (Right of engine side)




(Right and left of hydraulic pump side)



18. Lift off engine and hydraulic pump assembly (61).



 Engine and hydraulic pump assembly:
610 kg

Installation

- Carry out installation in the reverse order to removal.

[*1]

- Hydraulic oil drain plug:
58.8 – 78.5 Nm {6.0 – 8.0 kgm}

[*2] [*6]

- Radiator hose clamp bolt:
(Both upper hose and lower hose)
10.8 – 11.8 Nm {1.1 – 1.2 kgm}

[*3]

- ★ Procedure for installing MIKALOR clamp
- When tightening the clamp, apply the following lubricating oil or equivalent to its threaded part [C].
Lubricating oil: Threebond (PANDO 18B)
- Adjust bridge [A] so that it will be under band [B].
- Tighten until dimensions [L] and [M] are set to the specified dimensions.

Dimension L

Between aftercooler and air intake connector:

Aftercooler side: 10 (+0/-3) mm

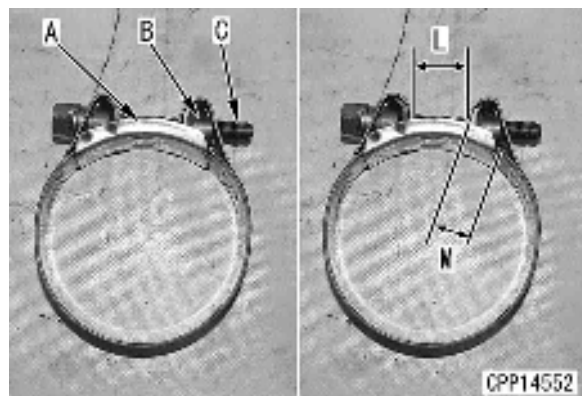
Air intake connector side:

16 (+0/-3) mm


Between aftercooler and turbocharger connector: 10 (0/-3) mm

Dimension M: Min. 5 mm


- If the tightened dimensions are out of the above ranges, replace the clamp with new one.
- Do not use an impact wrench.




[*4]

-  Hose clamp between turbocharger and air cleaner: (Turbocharger side)
10.0 – 11.0 Nm {1.02 – 1.12 kgm}

[*5]

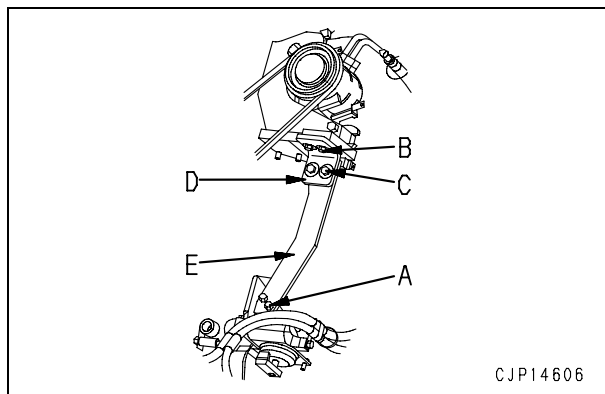
-  Connector mounting bolt:
10 ± 2 Nm {1.02 ± 0.2 kgm}

[*6]

-  Radiator lower hose clamp:
10.8 – 11.8 Nm {1.12 – 1.2 kgm}

[*7]

- If the air conditioner compressor bracket was removed, install it according to the following procedure.
 - 1) Tighten bolt A temporarily.
 - 2) While setting L-bracket D to stay E, tighten bolt B permanently.
 - ★ After tightening permanently, the clearance between L-bracket D and stay E must not exceed 2 mm.
 - 3) Loosen bolt A and move stay E to adjust the level difference in the forward and backward directions.
 - 4) Tighten bolts A and C in order.



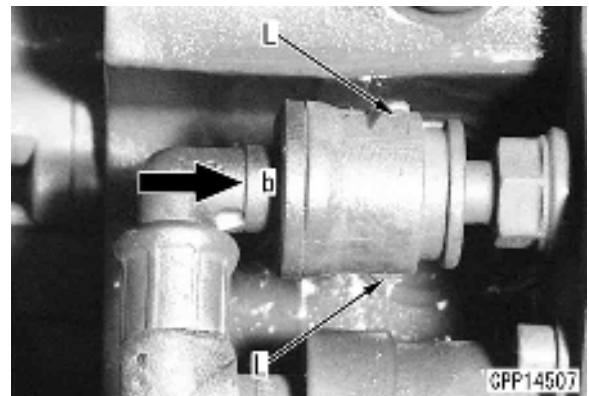
[*8]

When installing a connector of quick coupler type, observe the following points.


- ★ Replace the connector in the following cases.
 - 1] The connector was removed with pliers or a screwdriver or by bending it to the right and left.
 - 2] There is damage or deformation in the connector.
- ★ Check that mud or dirt is not sticking to the hose adapter in advance.
- ★ Press and insert the connector straight (in direction [b]) without bending it to the right or left.

(If it is difficult to insert the connector, do not push it in forcibly but pull it out.

Then, check the convex and concave parts for abnormality and mud.)



[*9]

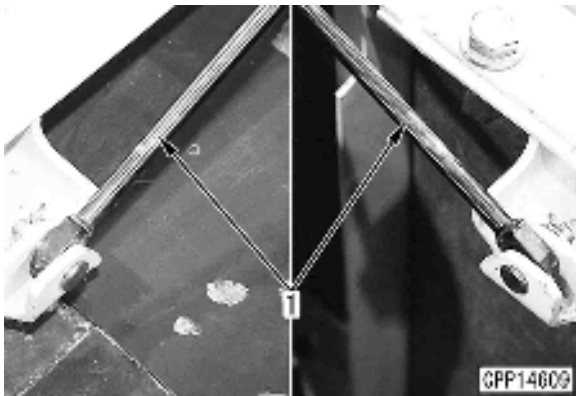
-  Mounting bolt:
245 – 308.7 Nm {25 – 31.5 kgm}

Removal and installation of engine hood assembly

Removal

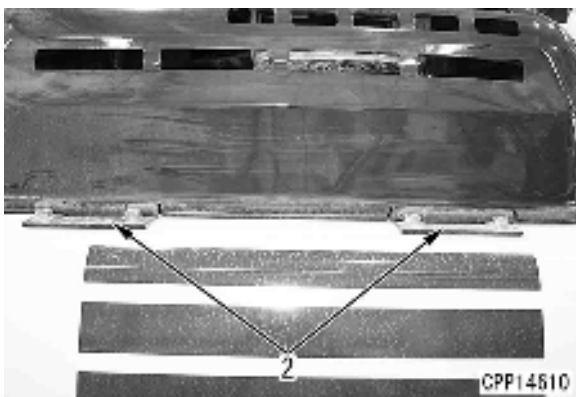
- ⚠ **Disconnect the cable from the negative (–) terminal of the battery.**

1. Sling the engine hood and remove right and left gas spring (1).




2. Remove the mounting bolts and disconnect hinges (2). [*1]

- ★ Before removing the bolts, check the installed positions of the hinges (right and left).



3. Lift off engine hood (3).

 Engine hood: **50 kg**

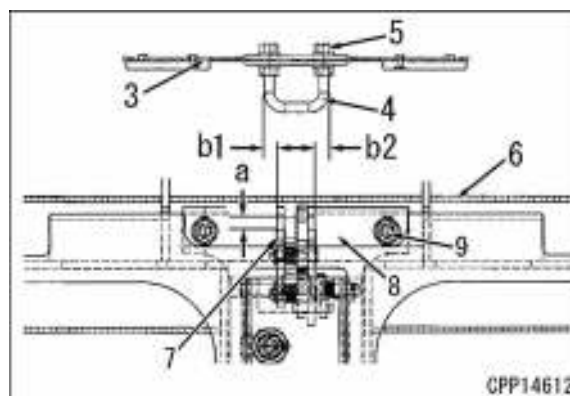
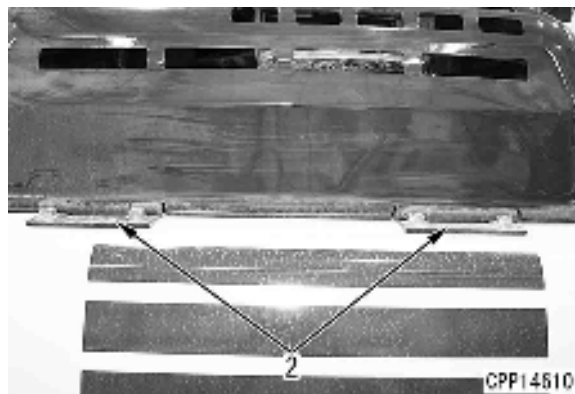


Installation

Carry out installation in the reverse order to removal.

[*1]

- Adjustment procedure for installed engine hood
 - 1) Install engine hood hinge (2) with the 4 mounting bolts.
 - ★ Tighten the bolts to the degree that the engine hood does not move in the right, left, forward or backward direction when it is opened and closed.
 - 2) Lower engine hood (3) slowly to bring U-bolt (4) to near catch (7) on the chassis side.
 - 3) Check that U-bolt (4) is set normally in catch (7) on the chassis side.
 - ★ U-bolt (4) must be set in groove (a) of catch (7).
 - ★ Distances (b1) on the left and (b2) on the right must be even.
 - 4) If the U-bolt is not set normally, loosen 2 mounting bolts (9) of catch bracket (8) and adjust catch bracket (8) in the forward, backward, right or left direction.
 - ★ Repeat steps 2) and 3) until the engine hood is opened and closed smoothly.
 - ★ If the engine hood cannot be adjusted perfectly by steps 2) and 3), loosen the mounting bolts of hinge (2) and adjust the position of hinge (2) and then repeat steps 2) and 3) again.
 - 5) After finishing adjustment, tighten the mounting bolts of hinge (2) and catch bracket (8) to the specified torque.
 - ★ Illustration "CPP14612" shows engine hood (3) and U-bolt (4) seen from the front of the machine.
 - ★ Illustration "CPP14612" shows catch (7), catch bracket (8) and step (6) seen from above the machine.



Removal and installation of fuel tank assembly

Removal

- ⚠ **Stop the machine on a level ground, lower the work equipment to the ground, stop the engine, and set the lock lever in the lock position.**
- ⚠ **Disconnect the cable from the negative (-) terminal of the battery.**

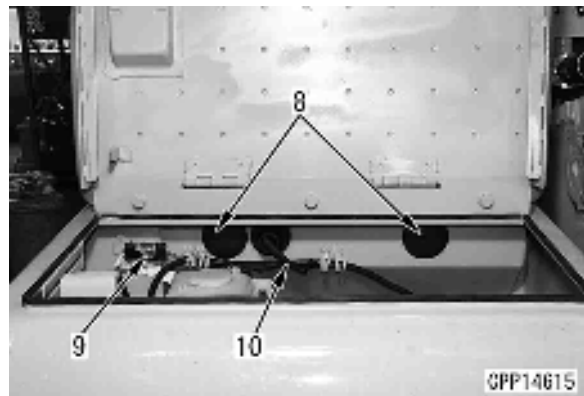
1. Open the rear right inspection cover and open fuel drain valve (1) to drain the fuel.
Fuel tank (when full): **280 ℓ**




2. Removal of handrail (2)
 - 1) Remove 4 mounting bolts (3) at the top of the engine compartment.
 - 2) Remove the 2 mounting bolts in tool case (4) and remove handrail (2).



3. Removal of cover (5)
 - 1) Remove 2 mounting bolts (6) which are mounting the cover to the engine compartment top.
 - 2) Open cover (7) of tool case (4), remove 2 rubber caps (8) on the right and left sides.
 - 3) Remove the 2 lower mounting bolts of cover (5).
 - ★ At this time, disconnect washer wiring connector (9) and fuel level sensor wiring connector (10).
(These connectors must be disconnected for removal of tool case (4) in step 4.)
 - 4) Remove cover (5).

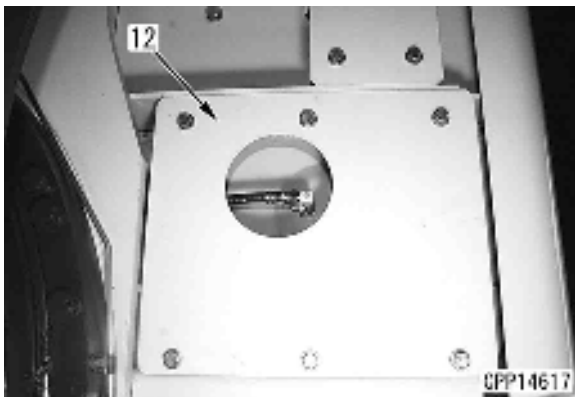


4. Remove the 4 mounting bolts of tool case (4) and lift off the tool case.
 Toolbox: **50 kg**

5. Remove cover (11).




6. Remove lower cover (12).



7. Disconnect hoses (13), (14) and (15).

8. Remove 6 fuel tank mounting bolts (16). [*1]



9. Lift off fuel tank assembly (17).
 Fuel tank assembly: **120 kg**



Installation

- Carry out installation in the reverse order to removal.

[*1]

Fuel tank mounting bolt:
245 – 309 Nm {25 – 31.5 kgm}

PC160LC-7E0, PC180LC/NLC-7E0 Hydraulic Excavator

Form No. UEN02448-00

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HYDRAULIC EXCAVATOR

PC160LC-7E0

PC180LC-7E0

PC180NLC-7E0

Machine model	Serial number
---------------	---------------

PC160LC-7E0	K45001 and up
PC180LC-7E0	K45001 and up
PC180NLC-7E0	K45001 and up

50 Disassembly and assembly

Power train

Removal and installation of travel motor and final drive assembly	2
Disassembly and assembly of final drive assembly	3
Removal and installation of swing motor and swing machinery assembly	10
Disassembly and assembly of swing motor and swing machinery assembly	12
Removal and installation of swing circle assembly	20

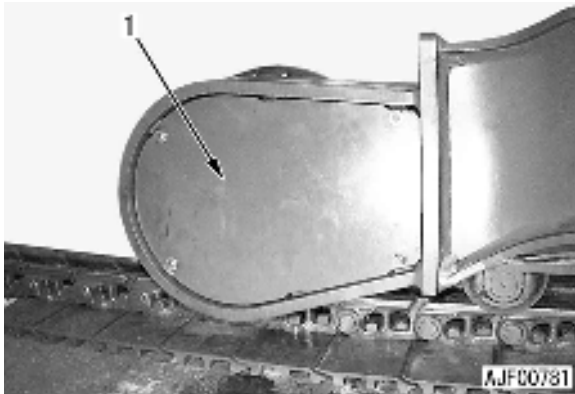
Removal and installation of travel motor and final drive assembly

Removal

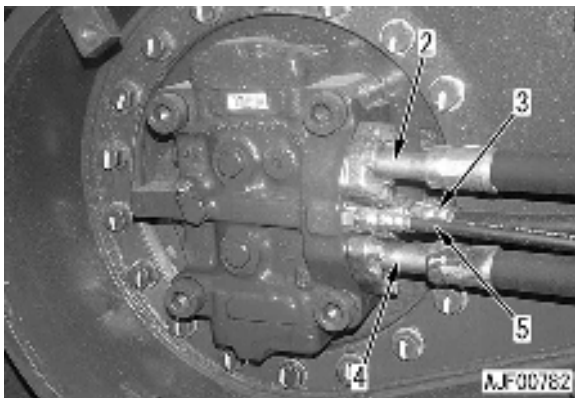
1. Remove the sprocket, refer to the removing sprocket section in this manual.

⚠ Lower the work equipment to the ground for safety. Stop the engine and loosen the oil filler cap on the hydraulic tank to release pressure inside.


2. Remove cover (1).

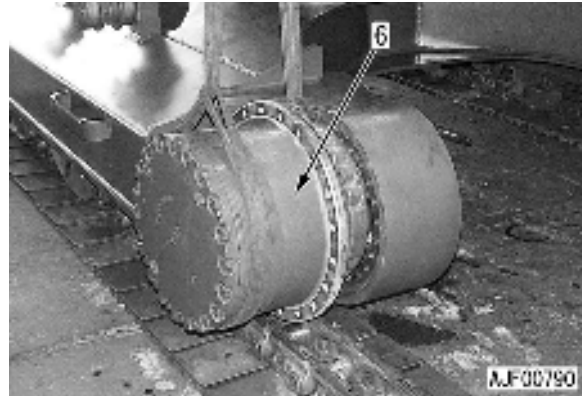


3. Disconnect four travel motor hoses (2), (3), (4) and (5).



4. Remove the 18 mounting bolts from final drive assembly (6) and lift it off to remove. [*1]
 - ★ Be careful. Do not damage the face of the fitting seal at the base of the hose.
 - ★ When lifting off the final drive assembly, do not use a tapped hole for lifting the cover.


 Final drive assembly: **330 kg**



Installation

- Install in reverse order to removal.

[*1]

 Final drive assembly mounting bolt:
245 – 309 Nm {25 – 31.5 kgm}

- Refilling hydraulic oil
Refill hydraulic oil through the oil filler port to the specified level, and left the oil circulate in the hydraulic system by starting the engine. Then check the oil level again.
- Bleeding air
 - ★ Bleed air. For details, see Testing and adjusting, "Bleeding air from each part".

Disassembly and assembly of final drive assembly

Special tools

Sym-bol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
F	1	796-427-1200	Wrench	■	1	
		796T-427-1220	Push tool	■	1	○
		790-101-2510	Block	■	1	
		792-104-3940	Bolt	■	2	
	2	01580-11613	Nut	■	2	
		01613-31645	Washer	■	2	
		790-105-2100	Jack	■	1	
		790-101-1102	Pump	■	1	
3	791-545-1510	Installer	■	1		

Disassembly

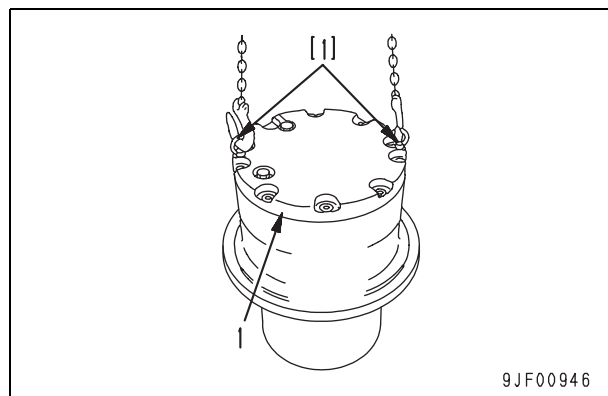
1. Draining oil

Remove the drain plug to drain the oil from the final drive case.

 Final drive case: 3.5 ℓ

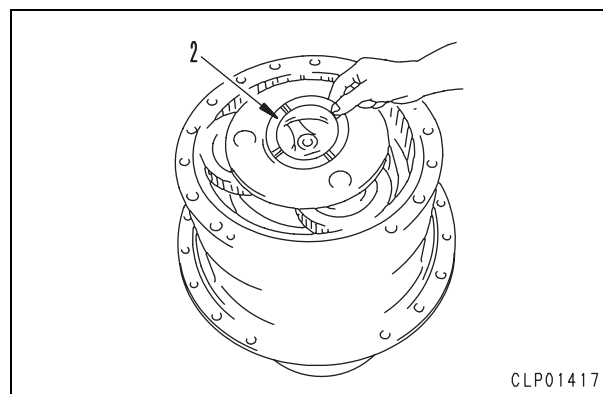
2. Cover

Remove the mounting bolts. Using eyebolts [1], remove cover (1).



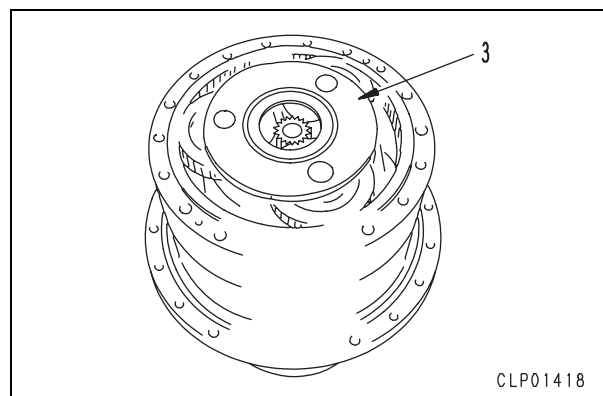
3. Washer

Remove washer (2).



4. No. 1 carrier assembly

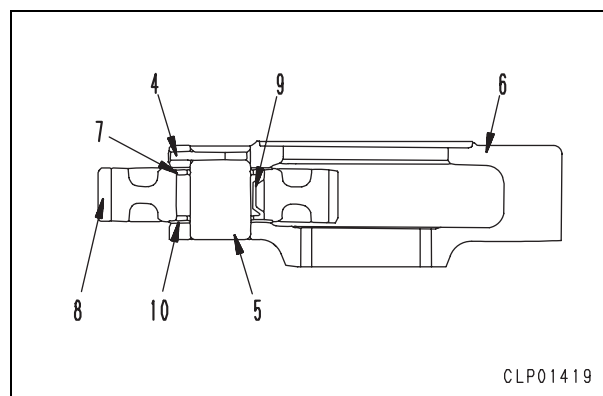
1) Remove No. 1 carrier assembly (3).



2) Push in pin (4) to drive shaft (5) out of carrier (6).

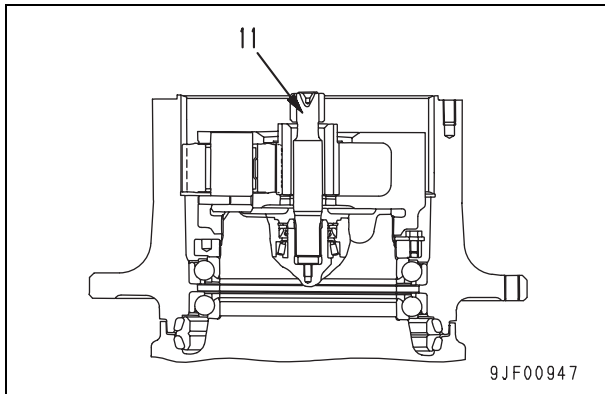
★ After removing the shaft, remove pin (4).

3) Remove thrust washer (7), gear (8), bearing (9), and thrust washer (10).



5. No. 1 sun gear shaft

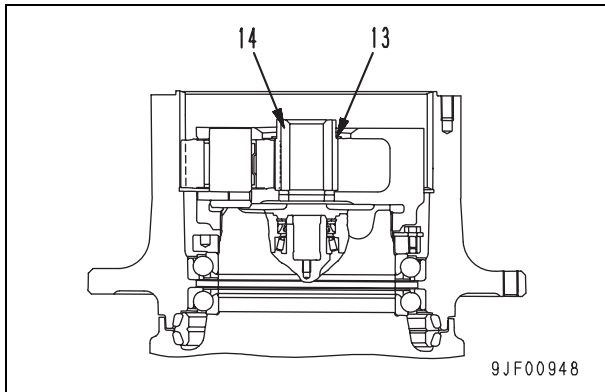
Remove No. 1 sun gear shaft (11).

**6. Thrust washer**

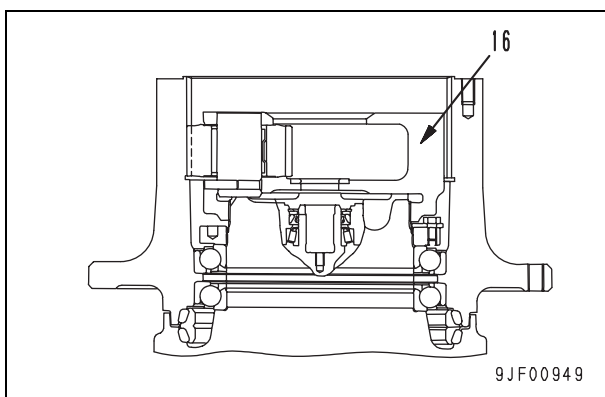
Remove thrust washer (13).

7. No. 2 sun gear

Remove No. 2 sun gear (14).

**8. No. 2 carrier assembly**

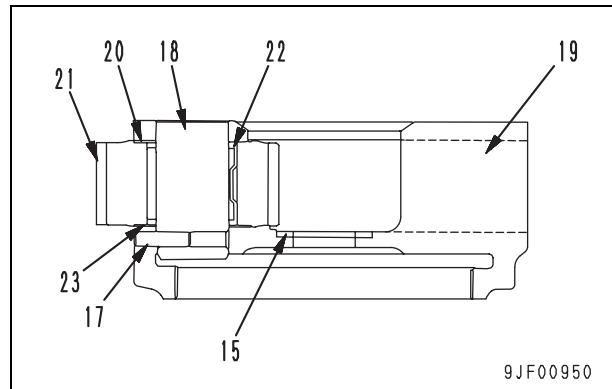
1) Remove No. 2 carrier assembly (16).



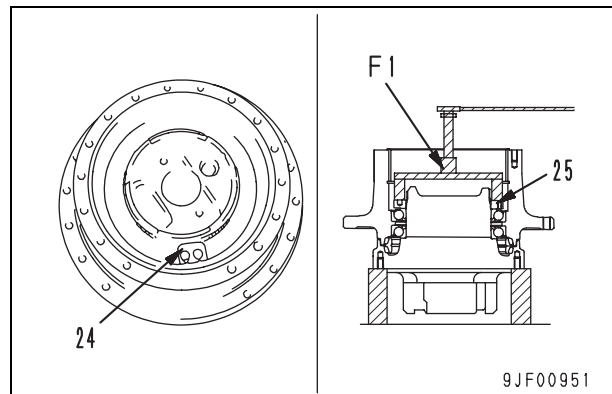
2) Push in pin (17) to drive shaft (18) and push the drive shaft (18) out of carrier (19).

★ After removing the shaft, remove pin (17).

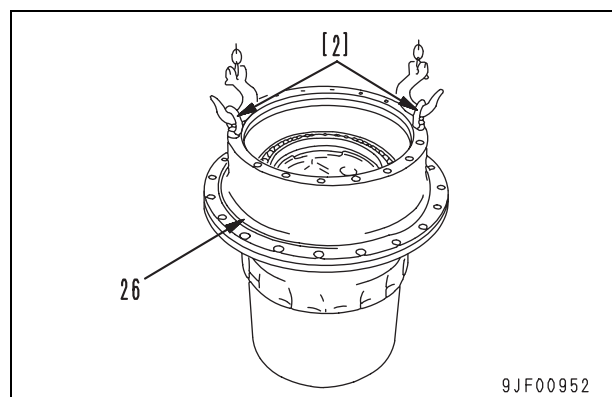
- 3) Remove thrust washer (20), gear (21), bearing (22), and thrust washer (23).
- 4) Remove thrust washer (15).

**9. Nut**

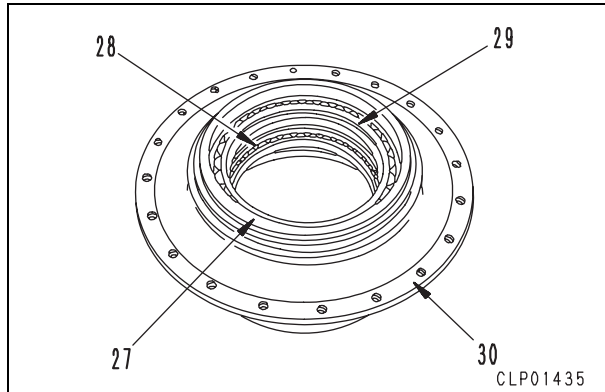
- 1) Remove lock plate (24).
- 2) Using tool F1, remove nut (25).

**10. Hub assembly**

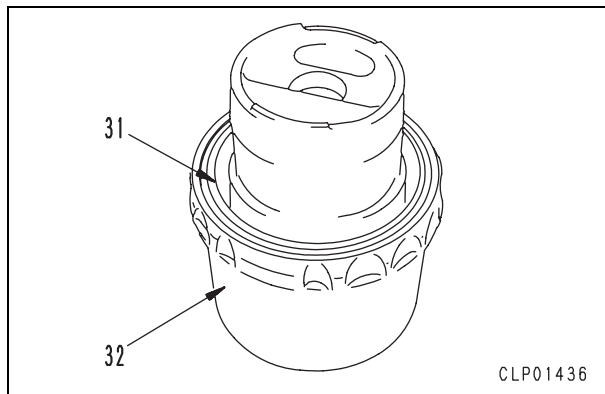
- 1) Using eyebolts [2], remove hub assembly (26) from the travel motor.



- 2) Remove floating seal (27).
- 3) Remove bearings (28) and (29) from hub (30).
 - ★ When removing bearing (28), do not hit the bearing plastic retainer.



- 4) Remove floating seal (31) from travel motor (32).

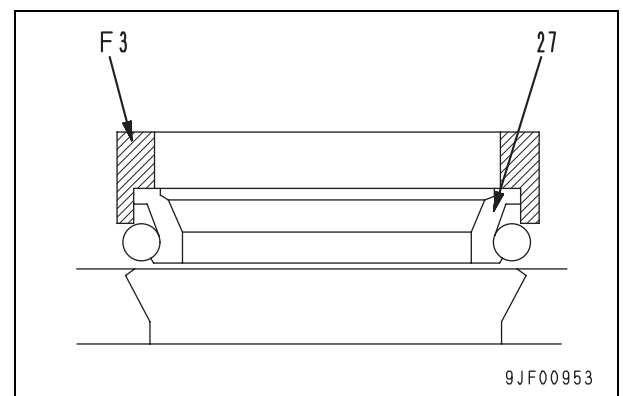
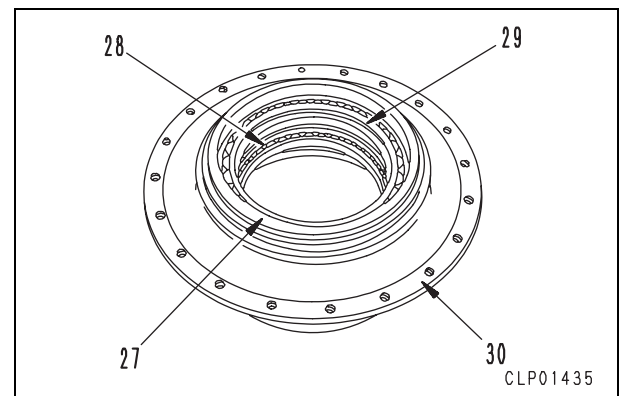


Assembly

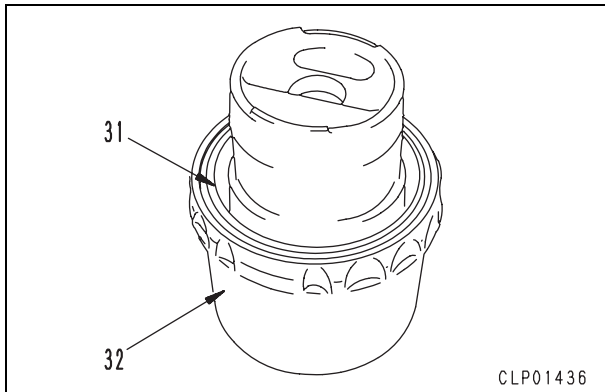
- ★ Clean the all parts and check them for dirt or damage. Coat their sliding surfaces with engine oil (EO30-CD) before installing.

1. Hub assembly

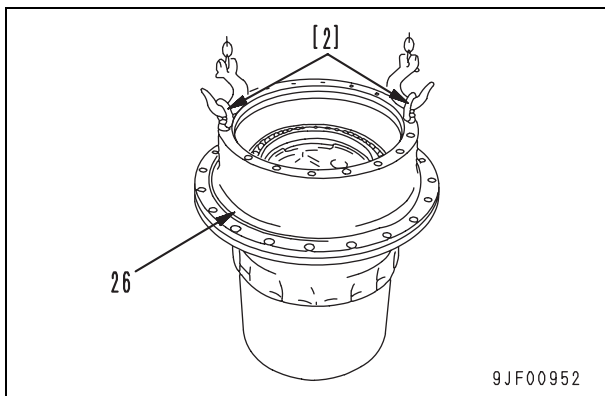
- 1) Using the push tool, press fit bearings (28) and (29) to hub (30).
- 2) Using tool **F3**, install floating seal (27).
 - ★ Thoroughly degrease and dry the O-ring and O-ring fitting surface of the floating seal before installing.
 - ★ After installing the floating seal, check that its slant is less than 1 mm.
 - ★ After installing the floating seal, thinly apply engine oil (EO30-CD) to the sliding surfaces.



- 3) Using tool **F3**, install floating seal (31) to travel motor (32).
★ For the procedure for installation, see 2).



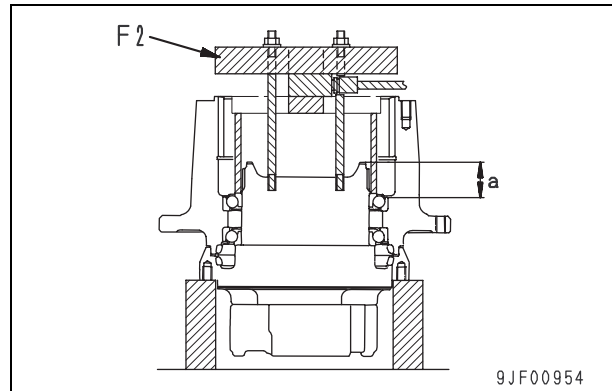
- 4) Using eyebolts [2], set hub assembly (26) to the travel motor.
- 5) Using and lightly hitting the push tool, press fit the bearing.



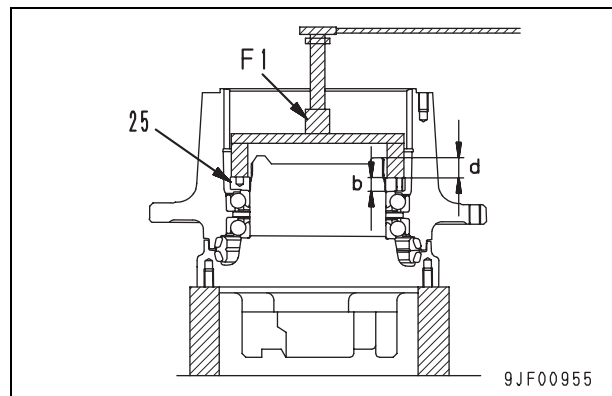
2. Nut

- 1) Using tool **F2**, press the bearing inner race.
★ Do not heat the bearing or press or hit the plastic retainer directly.
★ Pressing force:
8.8 – 12.7 kN {0.9 – 1.3 tons}
★ Before pressing the bearing inner race, revolve the hub 2 – 3 turns.

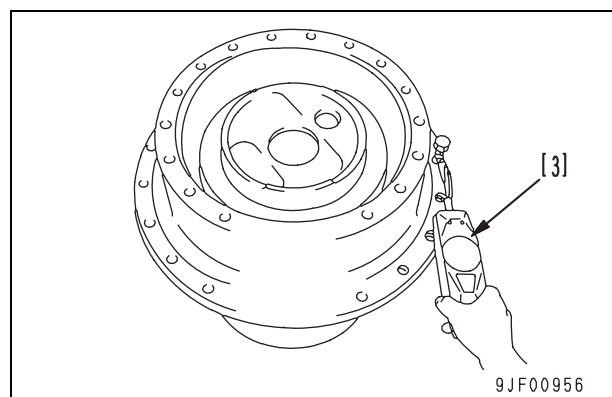
- 2) Under the above condition, measure dimension (a).



- 3) Measure thickness (b) of the nut.
- 4) Obtain (c) = (a) – (b).
(Refer to Fig"9JF00954" of procedure 2-2) for [a].)
- 5) Using tool F1, tighten nut (25) until dimension (d) is (c) 0/-0.1.




- 6) Using push-pull gauge [3], measure the starting tangential force of the hub in its revolving direction on the motor case.
★ Starting tangential force:
Max. 294 N {Max. 30 kg}



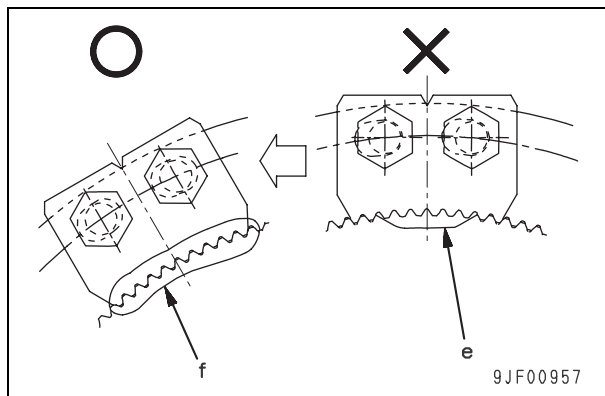
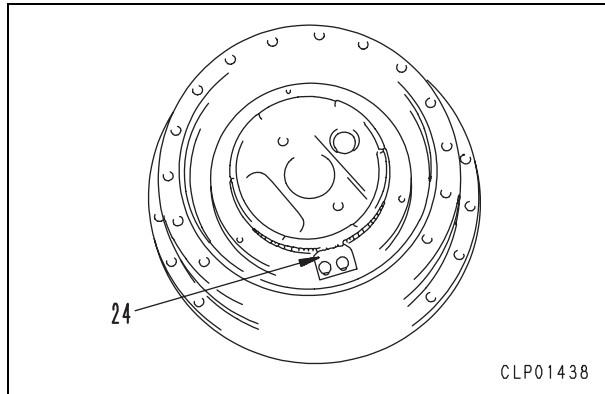
7) Install lock plate (24).

- ★ Install the lock plate around cut (e) of the travel motor, fitting it to the spline thoroughly (under condition (f)).

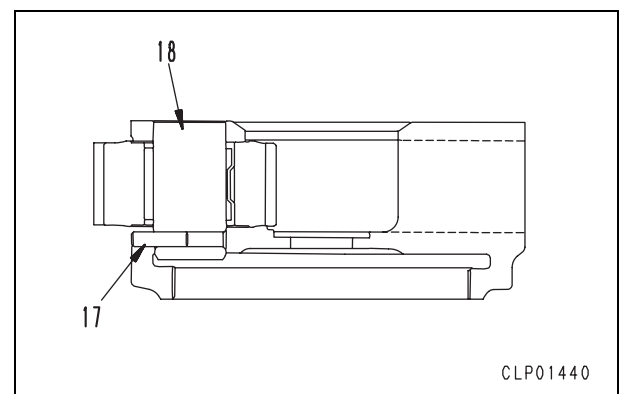
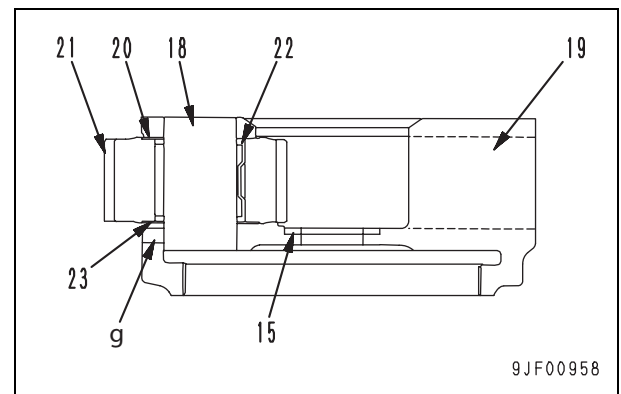
 Threads of mounting bolt:

Adhesive (LT-2)

- ★ Do not apply adhesive (LT-2) to the threads of the mating nut.

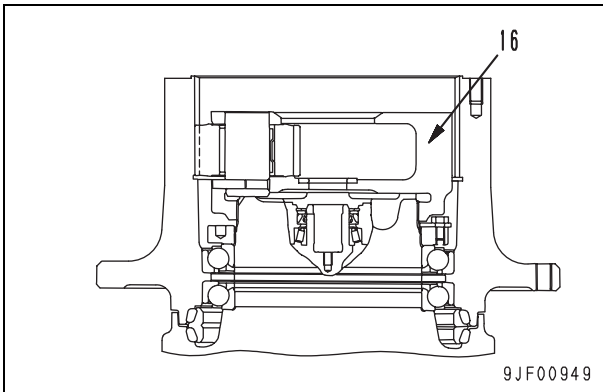
**3. No. 2 carrier assembly**

- 1) Install thrust washer (15).
- 2) Install bearing (22) to gear (21). Fit upper and lower thrust washers (20) and (23) and set the gear assembly to carrier (19).
 - ★ Replace thrust washers (20) and (23) with new ones.
 - ★ There is a caulking mark made when the pin was inserted at the end of carrier side hole g and the inside wall of the hole is swelled at that mark. Flatten the swelled part in advance.
- 3) Aligning the pin holes of shaft (18) and carrier, lightly hit the shaft with a plastic hammer, etc. to install.
 - ★ When installing the shaft, revolve the planetary gear and take care not to damage the thrust washers.
- 4) Insert pin (17).
 - ★ Replace the pin with new one.
 - ★ After inserting the pin, caulk the carrier by the part where the pin is inserted.
 - ★ After assembling the carrier, check that gear (21) revolves smoothly.



5) Install No. 2 carrier assembly (16).

- ★ Install No. 2 carrier assembly (16) so that the 3 gear shaft ends will be in the 3 hollows at the motor case end.

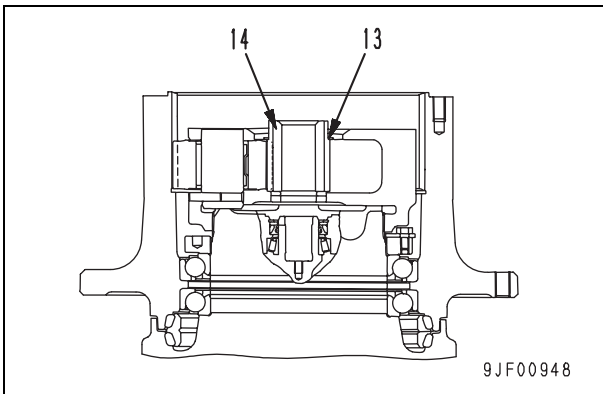


4. No. 2 sun gear

Install No. 2 sun gear (14).

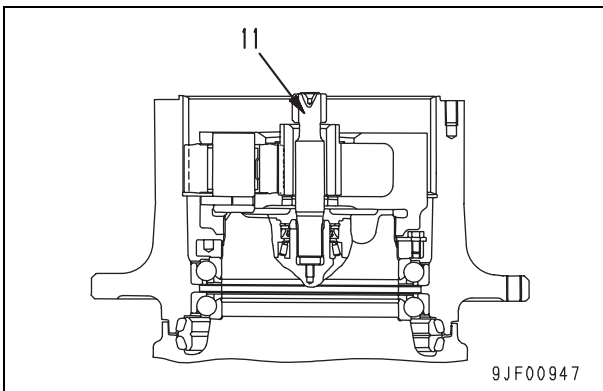
5. Thrust washer

Install thrust washer (13).



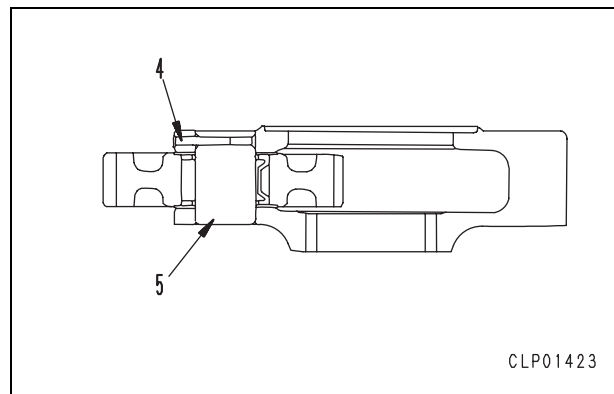
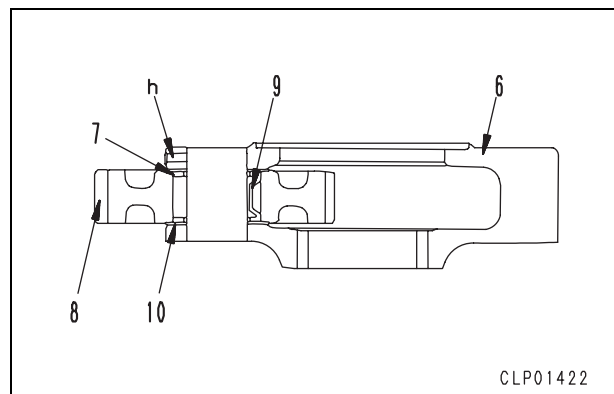
6. No. 1 sun gear shaft

Install No. 1 sun gear shaft (11).

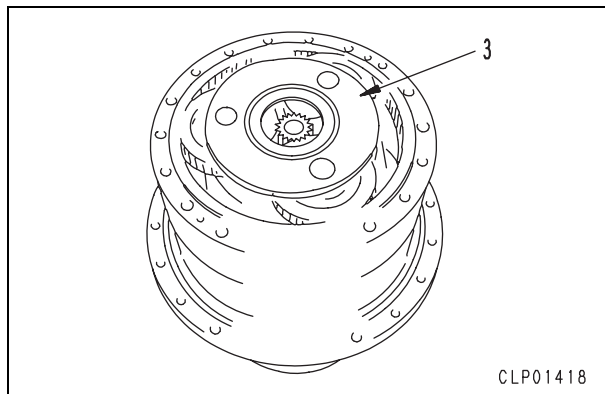


7. No. 1 carrier assembly

- 1) Install bearing (9) to gear (8). Fit upper and lower thrust washers (7) and (10) and set the gear assembly to carrier (6).
 - ★ Replace thrust washers (7) and (10) with new ones.
 - ★ There is a caulking mark made when the pin was inserted at the end of carrier side hole h and the inside wall of the hole is swelled at that mark. Flatten the swelled part in advance.
- 2) Aligning the pin holes of shaft (5) and carrier, lightly hit the shaft with a plastic hammer, etc. to install.
 - ★ When installing the shaft, revolve the planetary gear and take care not to damage the thrust washers.
- 3) Insert pin (4).
 - ★ Replace the pin with new one.
 - ★ After inserting the pin, caulk the carrier by the part where the pin is inserted.
 - ★ After assembling the carrier, check that gear (8) revolves smoothly.

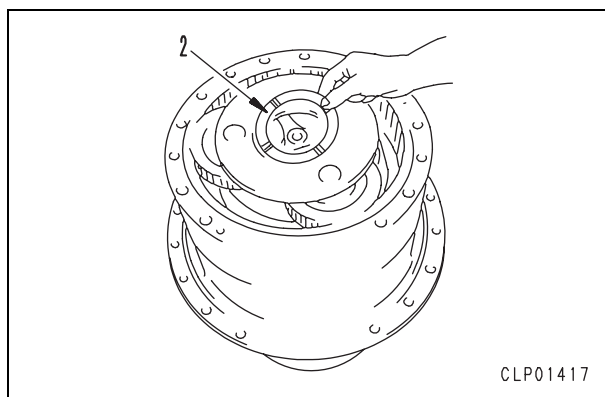


- 4) Install No. 1 carrier assembly (3).




8. Washer

Install washer (2).




9. Cover

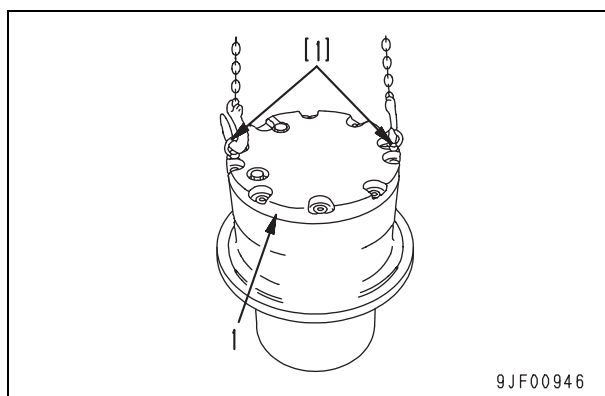
Using eyebolts [1], install cover (1) and tighten the mounting bolts.

 Cover mounting face:

Gasket sealant (LG-6)

 Mounting bolt:

98 – 123 Nm {10 – 12.5 kgm}



10. Refilling with oil

Tighten the drain plug and add engine oil through the oil filler.



Final drive case:

Approx. 3.5 ℓ (EO30-CD)

- ★ After installing the final drive assembly to the chassis, check the oil level again at the specified position.

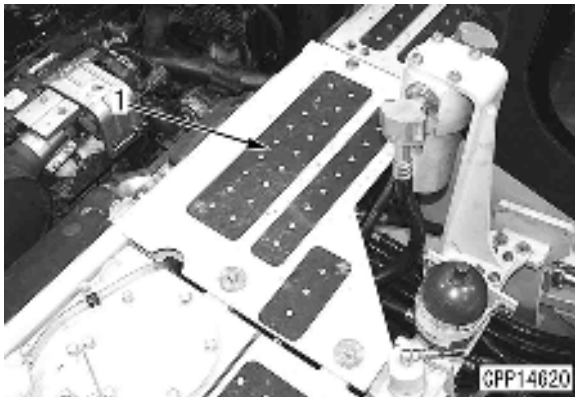
Removal and installation of swing motor and swing machinery assembly

Removal


- ⚠ Stop the machine on a level ground, lower the work equipment to the ground, stop the engine, and set the lock lever in the lock position.
- ⚠ Release the residual pressure in the hydraulic circuit. For details, see Testing and adjusting, "Releasing residual pressure in hydraulic circuit".
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.

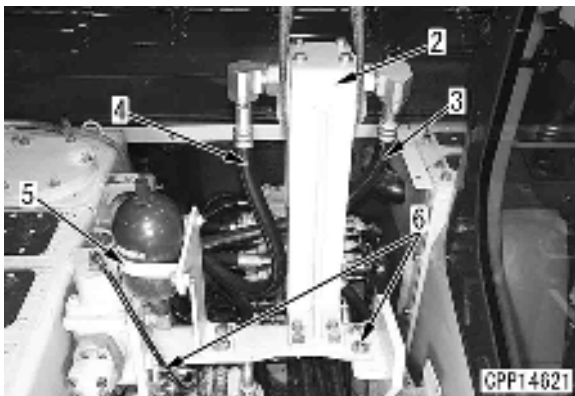
- ★ Put tags to the disconnected piping to prevent a mistake in re-connecting them.

1. Remove cover (1).

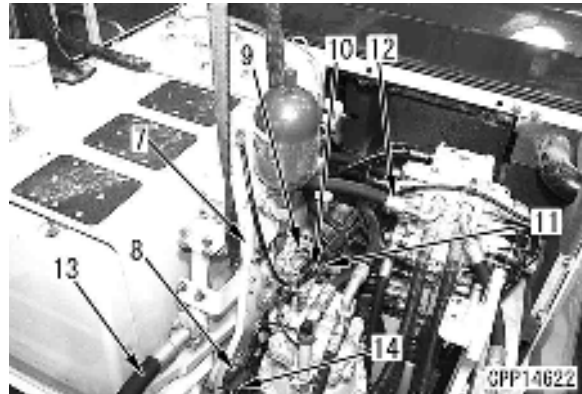


2. Removal of filter and bracket assembly (if equipped)
 - 1) Sling filter and bracket assembly (2).
 - 2) Disconnect hose (3) from the accumulator.
 - 3) Disconnect hose (4) from the tank.
 - 4) Remove accumulator mounting band (5).
 - 5) Remove 4 bracket mounting bolts (6) and lift off filter and bracket assembly (2).

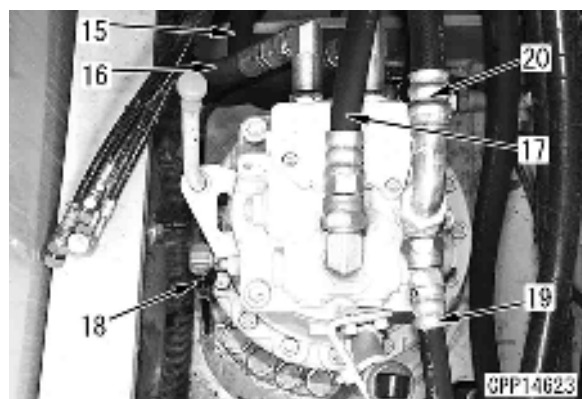
 Filter and bracket assembly: **40 kg**



3. Removal of accumulator and bracket assembly.
 - 1) Sling filter and bracket assembly (7).
 - 2) Disconnect wiring connector V07 (8).
 - 3) Disconnect 3 relay solenoid hoses (9), (10) and (11).
 - 4) Disconnect hose (12) from the control valve (service valve).
 - 5) Disconnect hose (13) from the accumulator outlet.
 - 6) Remove 4 bracket mounting bolts (14) and lift off filter and bracket assembly (7).



4. Disconnect swing motor hoses (15) – (20).
 - (15): Between swing motor and control valve (Port MA)
 - (16): Between swing motor and control valve (Port MB)
 - (17): Suction hose (Port S)
 - (18): Pilot for resetting swing brake (Port PB)
 - (19): Drain between swing motor and swivel joint (Port DB)
 - (20): Between swing motor and hydraulic tank (Port DB)




5. Remove 13 mounting bolts (21). [*1]

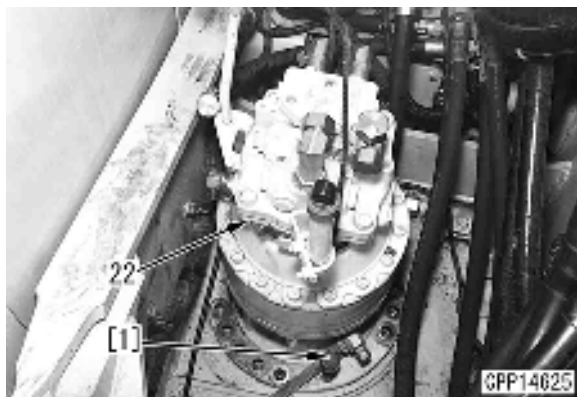


6. Sling swing motor and swing machinery assembly (22) and disconnect it from the machine by using forcing screw [1].

7. Lift off swing motor and swing machinery assembly (22).

- ★ When lifting the assembly, take care that it will not interfere with the hoses around it.

 Swing motor and swing machinery assembly: **170 kg**



Installation

- Carry out installation in the reverse order to removal.
- Refilling with oil
 - ★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.
- Bleeding air
 - ★ Bleed air. For details, see Testing and adjusting, "Bleeding air from each part".

[*1]

Swing machinery mounting bolt:

490 – 608 Nm {50 – 62 kgm}

Disassembly and assembly of swing motor and swing machinery assembly


Special tools

Sym-bol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
G	1	KBATZ080080	Wrench	■	1	
	2	KBATZ030190	Adapter	■	1	
	3	KBATZ060400	Stopper	■	1	

Disassembly

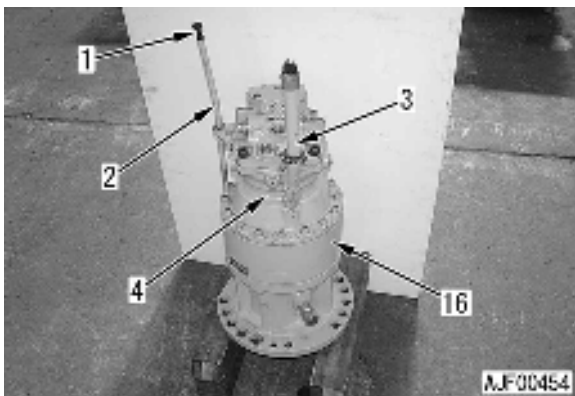
1. Draining oil

Loosen the drain plug and drain the oil from the swing machinery case.

 Swing machinery case: **4.5 ℓ**

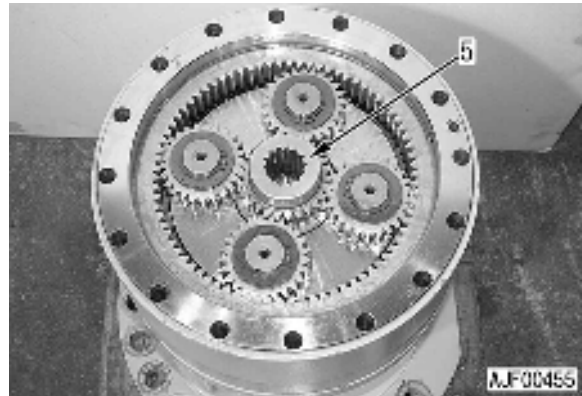
2. Swing motor assembly

- 1) Set the swing motor and swing machinery assembly on blocks.
- 2) Pull out level gauge (1) and remove pipe (2) and bracket.
 - ★ Turn and remove pipe (2).
- 3) Loosen the mounting nut of pipe (3) and remove the pipe and bracket together.
- 4) Lift off swing motor assembly (4).
 - ★ Make match marks on the swing motor case and cover (16) for reassembly.



3. No. 1 carrier assembly

- 1) Remove No. 1 sun gear (5).



- 2) Remove No. 1 carrier assembly (6).

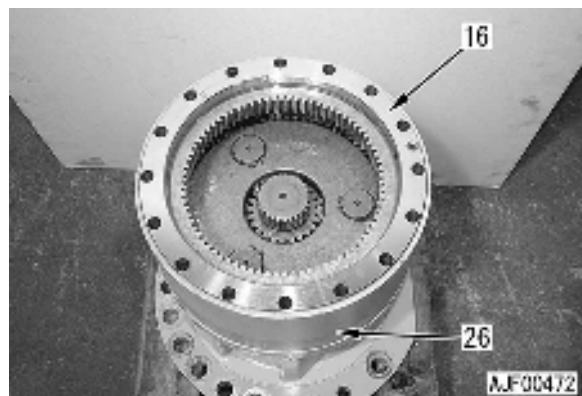
★ Insert a flat-head screwdriver, etc. under planetary gear (7) to float and remove the planetary gear.



4. Cover

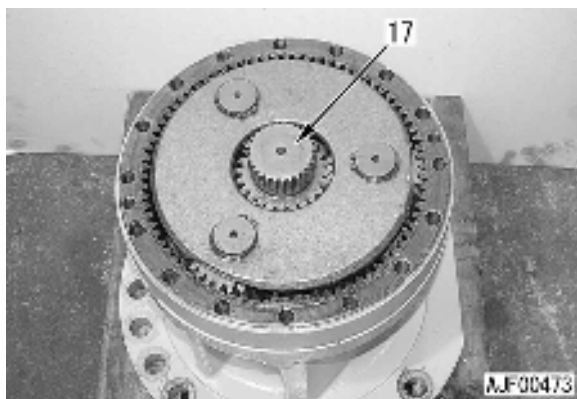
Remove cover (16).

★ Make match marks on cover (16) and ring gear (26) for re assembly.

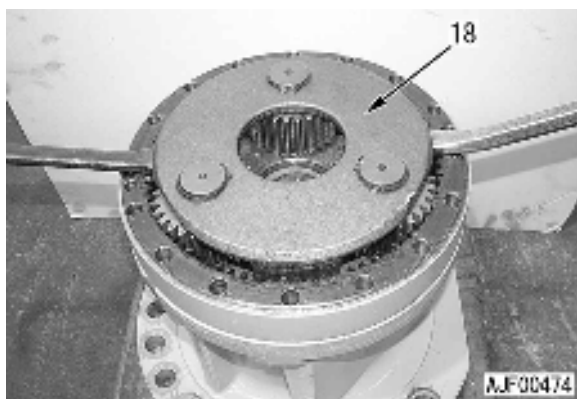


5. No. 2 carrier assembly

- 1) Remove No. 2 sun gear (17).

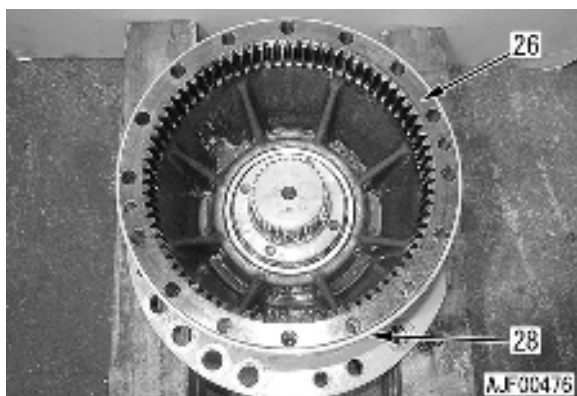


- 2) Using a bar, etc., float and remove No. 2 carrier assembly (18).

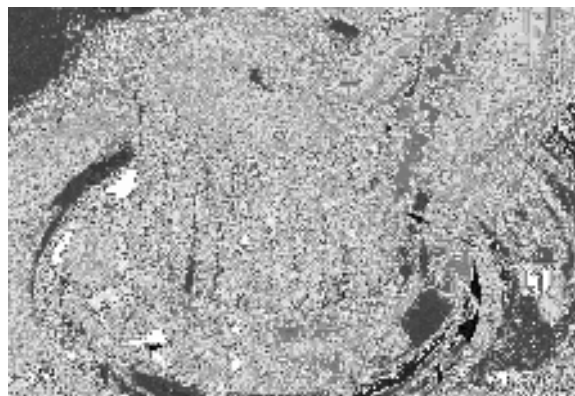
**6. Ring gear**

Remove ring gear (26).

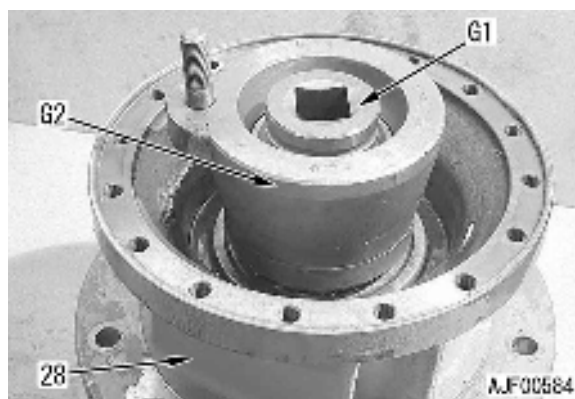
- ★ Make match marks on ring gear (26) and housing (28) for re assembly.

**7. Ring nut**

- 1) Using punch [1], etc., straighten the bent parts (3 places) of ring nut (27) around the pinion shaft spline.



- 2) Place the flange of housing (28) on a block and float the pinion shaft at the centre.
- 3) Install tool **G1** to the pinion shaft and install tool **G2** to the ring nut.

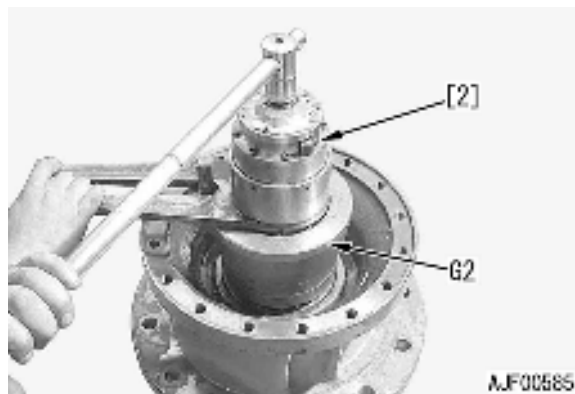


- 4) Fix tool **G2**. Using power wrench (25-time power) [2], turn tool **G1** to loosen the ring nut.

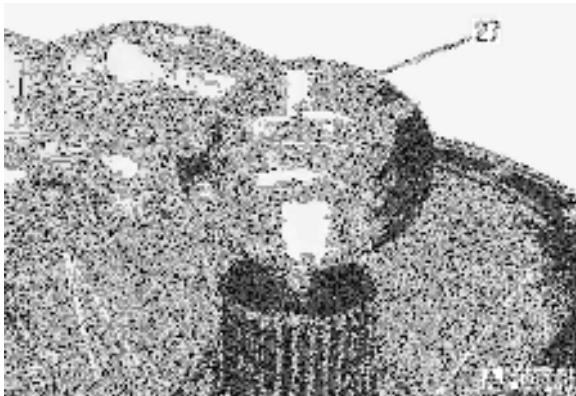
(Refer to Fig "AJF00584" of procedure 7-3 for tool **G1**.)

- Tightening torque of ring nut (Reference):

1100 – 1200 Nm {112.2 – 122.3 kgm}



- 5) Remove ring nut (27).

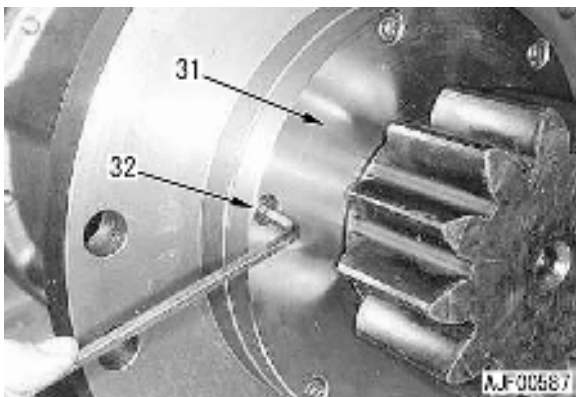


- 3) Using a press, separate pinion shaft assembly (29) and bearing (30).



8. Housing and pinion shaft

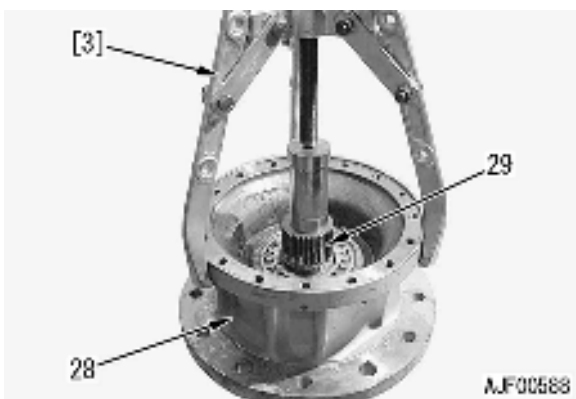
- 1) Remove 6 mounting screws (32) of front cover (31).



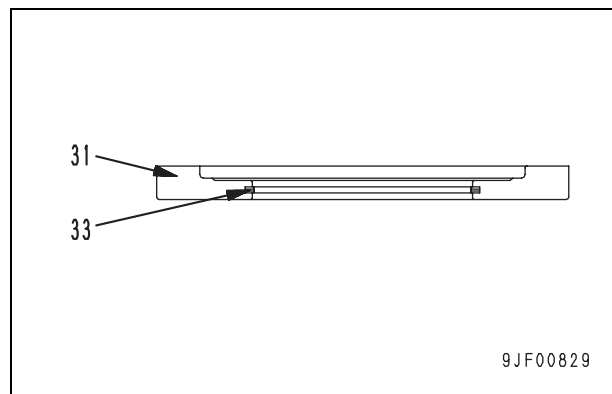
- 4) Remove front cover (31) and spacer (36).



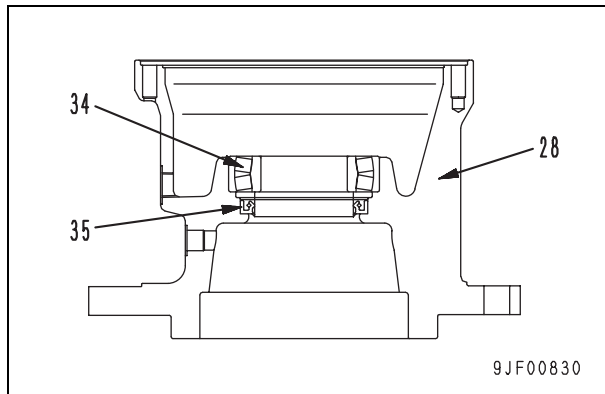
- 2) Using puller [3], separate housing (28) and pinion shaft assembly (29).



- 5) Remove seal ring (33) from front cover (31).



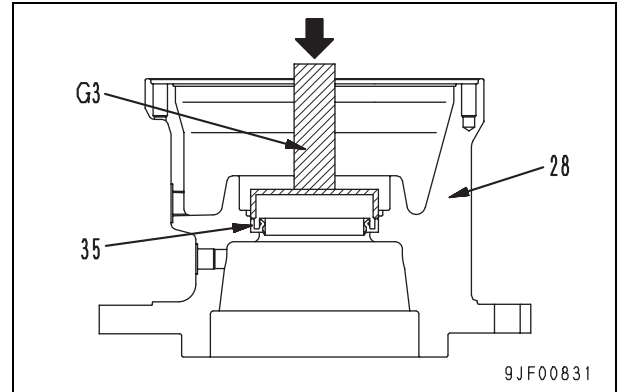
- 6) Remove bearing (34) and oil seal (35) from housing (28).



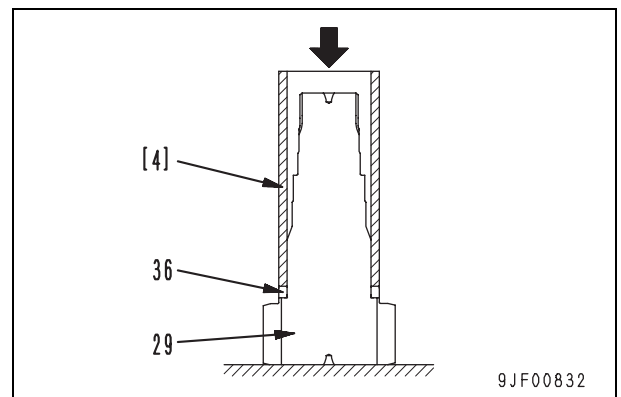
Assembly

1. Housing and pinion shaft

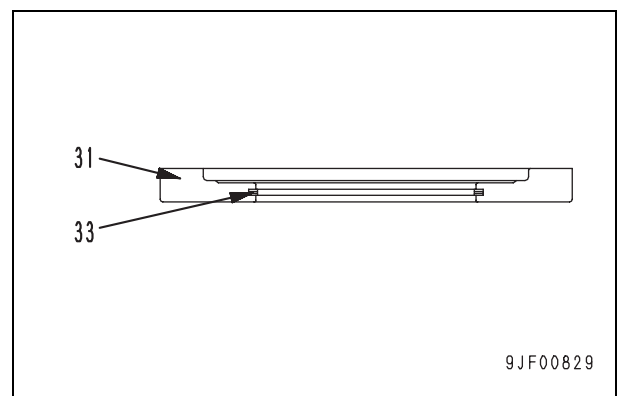
- 1) Using tool **G3**, install oil seal (35) to housing (28) as shown in the following figure.
 ★ Press fit the oil seal until its end reaches the housing end.



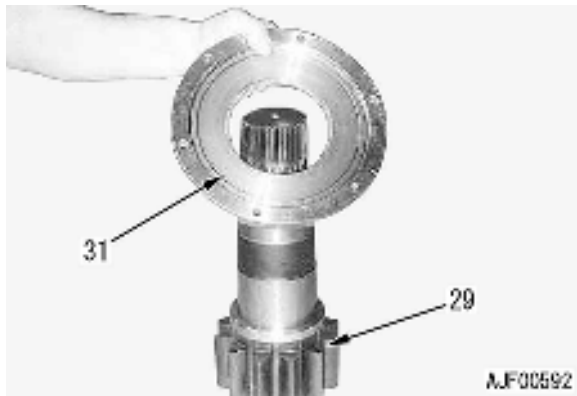
- 2) Using push tool [4], press fit spacer (36) to pinion shaft (29).



- 3) Install seal ring (33) to front cover (31).




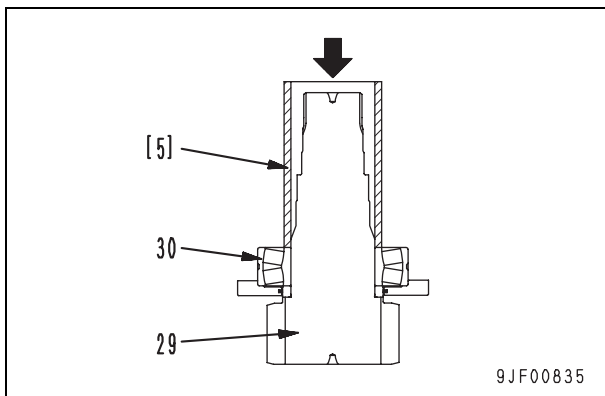
- 4) Set front cover (31) to pinion shaft (29).




- 5) Using push tool [5], press fit bearing (30) to pinion shaft (29).

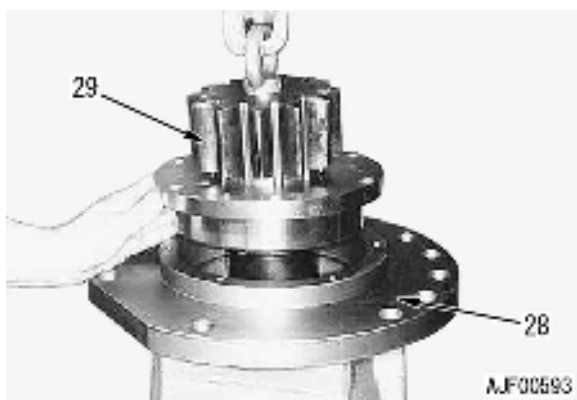
★ Press fit the bearing until the inner race end reaches the spacer.

 Bearing: **Grease**
(SHELL RETINAX HD-2 or equivalent)



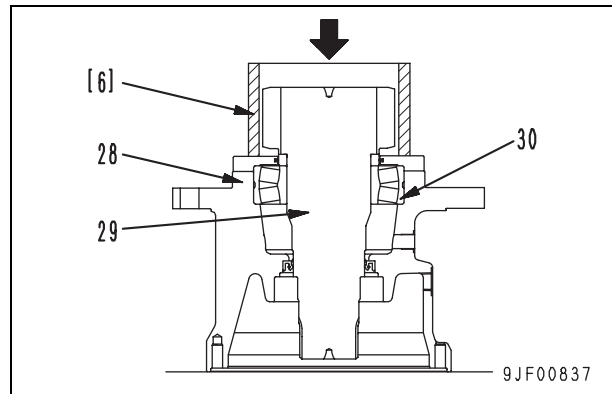
- 6) Set pinion shaft assembly (29) to housing (28).

 Housing: **Grease**
(SHELL RETINAX HD-2 or equivalent)





- 7) Using push tool [6], press fit pinion shaft assembly (29) to housing (28).

★ Press fit the bearing until the end of bearing (30) reaches the end of housing (28).



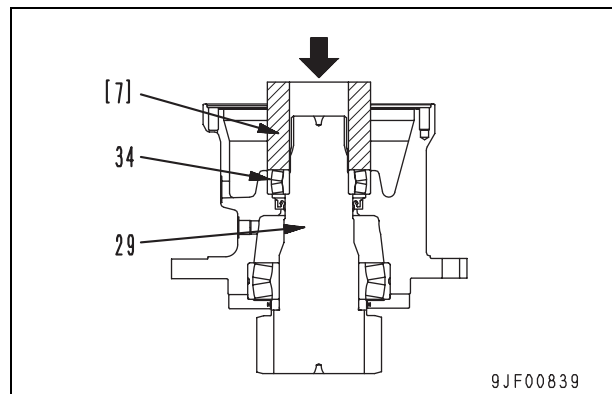
- 8) Tighten 6 front cover mounting screws (32).

 Mounting screw:
LOCTITE 243 or equivalent
 Mounting screw: **25 Nm {2.5 kgm}**



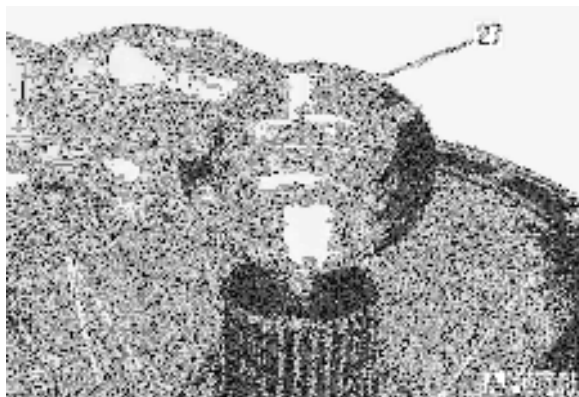
- 9) Using push tool [7], press fit bearing (34).

★ Press fit bearing (34) until its end reaches the shoulder of pinion shaft (29).



2. Ring nut

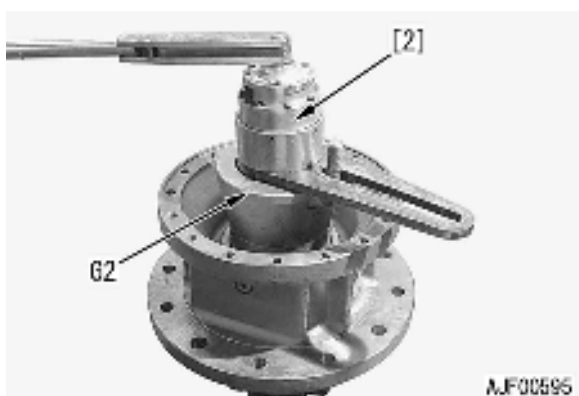
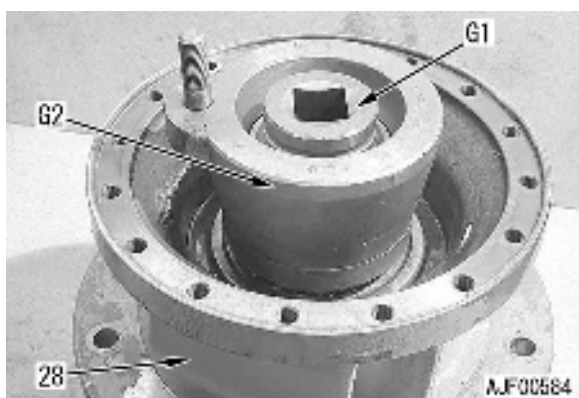
- 1) Install ring nut (27) to the pinion shaft.



- 2) Place the flange of housing (28) on blocks and float the pinion shaft at the centre.
- 3) Install tool **G1** to the pinion shaft and install tool **G2** to the ring nut.
- 4) Fix tool **G2**. Using power wrench (25-time power) [2], turn tool **G1** to tighten the ring nut.

⌚ Ring nut:

1100 – 1200 Nm {112.2 – 122.3 kgm}



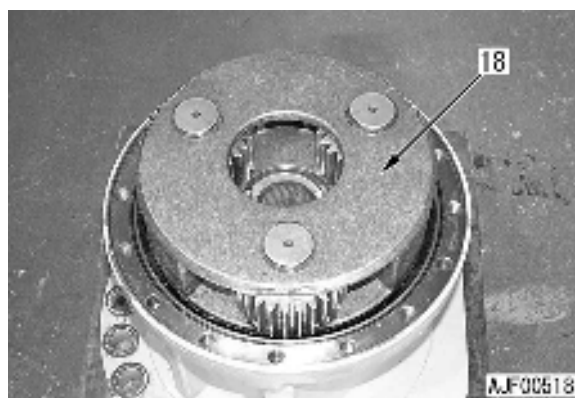
- 5) Using a punch, etc., bend the inside parts of ring nut (27) toward the spline of pinion shaft (29).

★ Bend 3 parts at intervals of 120 °.

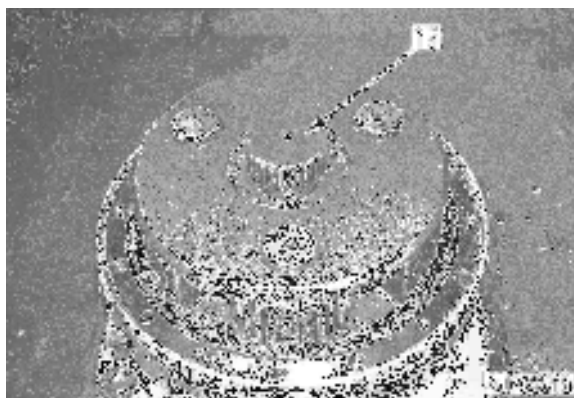


3. No. 2 carrier assembly

- 1) Install No. 2 carrier assembly (18).



- 2) Install No. 2 sun gear (17).

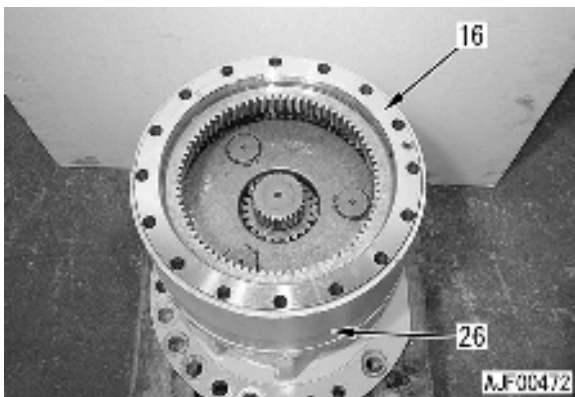


4. Ring gear

- 1) Fit the O-ring to the housing.
- 2) Install ring gear (26).
 - ★ Match the match marks made when the ring gear was removed.

**5. Cover**

- 1) Fit the O-ring to the ring gear mounting face of cover (16).
- 2) Install cover (16).
 - ★ Match the match marks made when the cover was removed.

**6. No. 1 carrier assembly**

- 1) Install No. 1 carrier assembly (6).

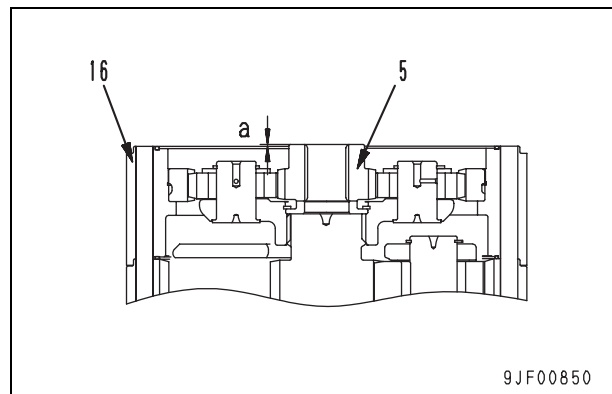


- 2) Install No. 1 sun gear (5).



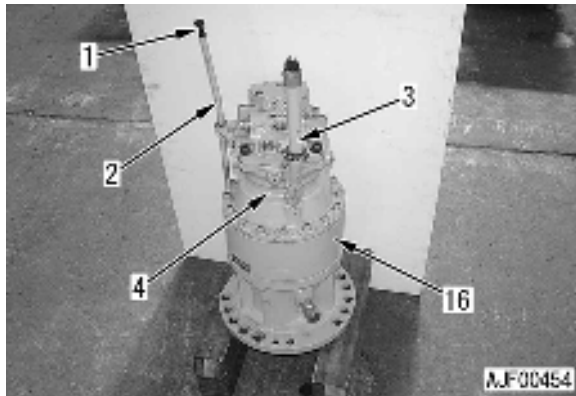
- 3) Check that dimension (a) from the end of cover (16) to the end of No. 1 sun gear (5) is as follows.

- Dimension (a) = $1.5 \begin{smallmatrix} 0 \\ -0.5 \end{smallmatrix} \text{ mm}$



7. Swing motor assembly

- 1) Install swing motor assembly (4).
 - ★ Match the match marks made when the swing motor assembly was removed.
 - 🔧 Mounting bolt:
 $85 \pm 4.3 \text{ Nm}$ { $8.7 \pm 0.44 \text{ kgm}$ }
- 2) Install pipe (3) and bracket.
 - 🔧 Pipe mounting nut (2 places):
 $56.4 \pm 7.3 \text{ Nm}$ { $5.8 \pm 0.74 \text{ kgm}$ }
- 3) Install pipe (2) and bracket and insert level gauge (1).
 - 🔧 Pipe:
 $12.3 \pm 2.5 \text{ Nm}$ { $1.25 \pm 0.25 \text{ kgm}$ }

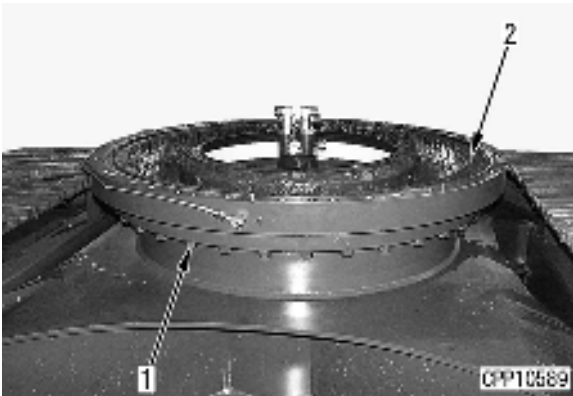
**8. Refilling with oil**


- 🛢 Swing machinery case:
4.5 ℓ (EO30-CD)

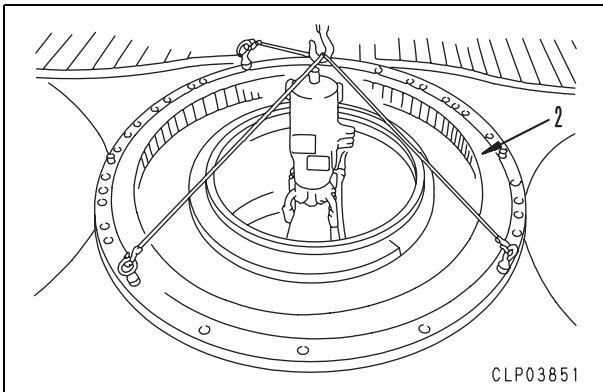
Removal and installation of swing circle assembly

Removal

1. Remove the revolving frame assembly. For details, see Removal and installation of revolving frame assembly.
2. Remove 36 mounting bolts (1). [*1]




3. Lift off swing circle assembly (2). [*2]
 Swing circle assembly: **270 kg**




Installation

- Carry out installation in the reverse order to removal.


[*1]

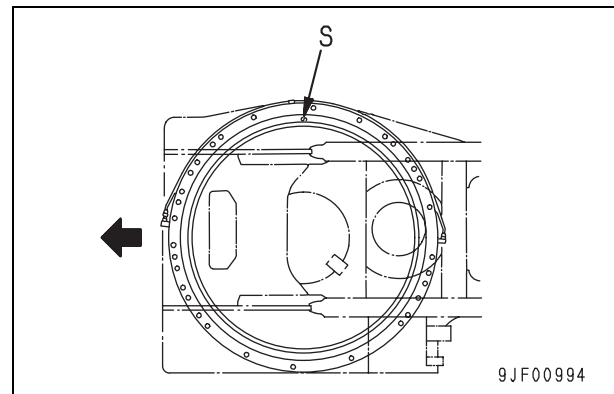
 Threads of swing circle mounting bolt:
Adhesive (LT-2)

 Swing circle mounting bolt:
 1st time:
 $191.2 \pm 19.6 \text{ Nm}$ { $19.5 \pm 2 \text{ kgm}$ }
 2nd time: **Re tighten by $48^\circ \pm 5^\circ$**
(Angle tightening)

[*2]

- ★ Set the soft zone (marked with (S)) of the inner race on the right side of the machine. (The arrow indicates the front of the machine.)

 Quantity of grease for circle:
Grease (G2-LI), 10.5 ℓ



PC160LC-7E0, PC180LC/NLC-7E0 Hydraulic Excavator

Form No. UEN02449-00

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HYDRAULIC EXCAVATOR

PC160LC-7E0

PC180LC-7E0

PC180NLC-7E0

Machine model	Serial number
---------------	---------------

PC160LC-7E0	K45001 and up
PC180LC-7E0	K45001 and up
PC180NLC-7E0	K45001 and up

50 Disassembly and assembly

Undercarriage and frame

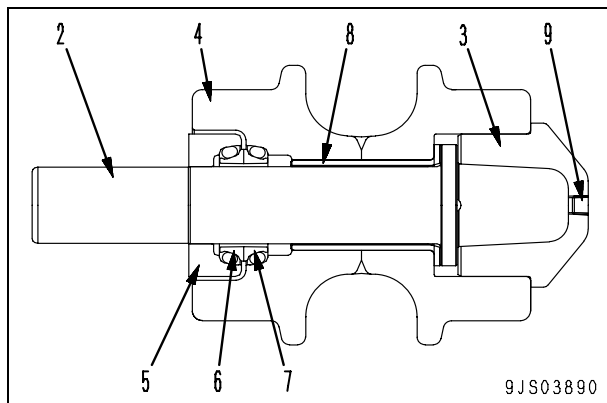
Disassembly and assembly of carrier roller	2
Disassembly and assembly of track roller assembly	5
Disassembly and assembly of idler assembly	7
Disassembly and assembly of recoil spring	10
Expansion and installation of track shoe assembly	12
Removal and installation of sprocket	14
Removal and installation of revolving frame assembly	15
Removal and installation of counterweight	17

Disassembly and assembly of carrier roller

Special tools


Sym- bol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
L 1	790-434-1660	Installer	■	1		

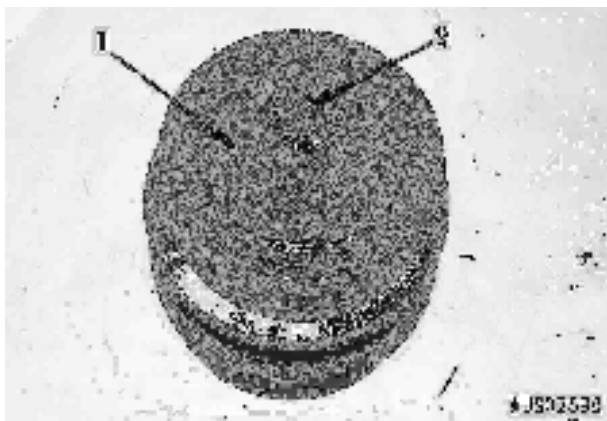
- Sectional view
- ★ A number shows the number in the text.



Disassembly

1. Remove plug (9) and drain the oil from carrier roller (1).

 Carrier roller 75 – 85mℓ

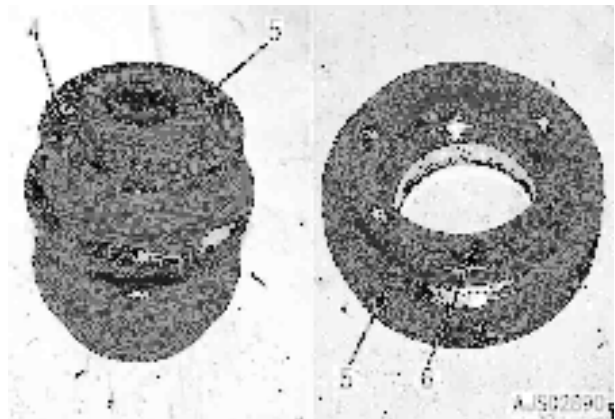


2. Using push tool [1], push the end surface of a shaft and remove the following from carrier roller (1):
 - Roller (4) ring (5) assembly, shaft (2) and cover (3).
 - Press fitting force (reference):
59 kN {6,000 kg} Min
- ★ The press fitted shaft (2) and ring (5), and also roller (4) and cover (3) will be both disassembled.

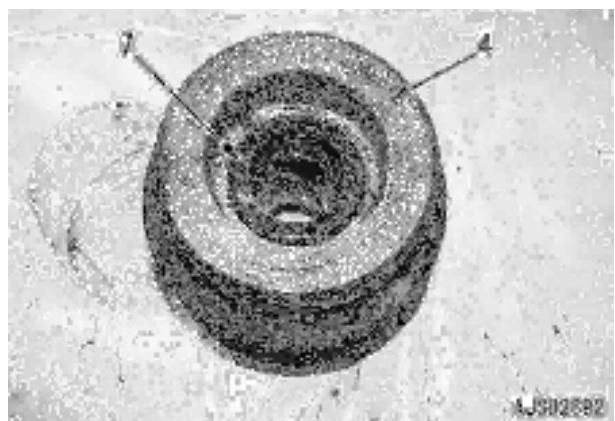
- ★ Cover (3) is placed under shaft (2).



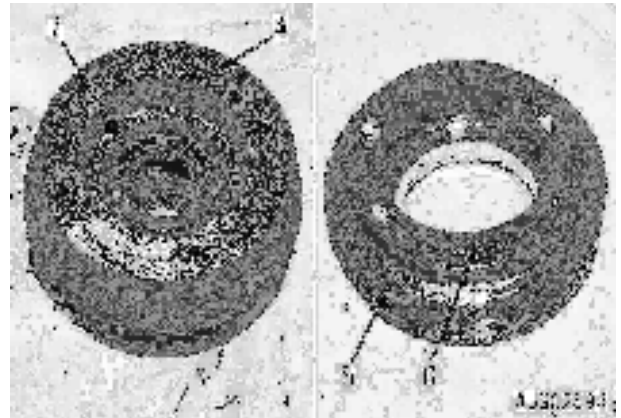
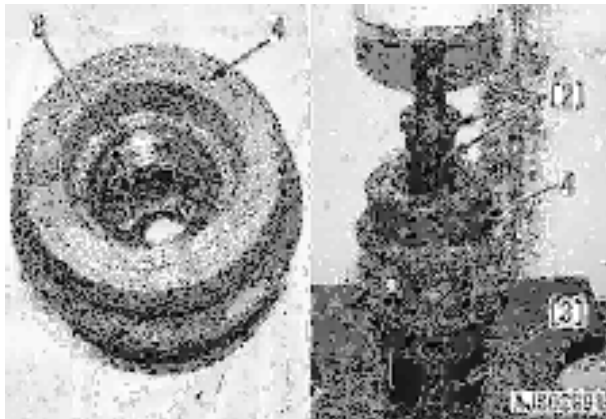
3. Remove ring (5) from roller (4).
4. Remove floating seal (6) from ring (5).
 - ★ Take care not to damage the sealing surface.



5. Remove floating seal (7) from roller (4).
 - ★ Take care not to damage the sealing surface.



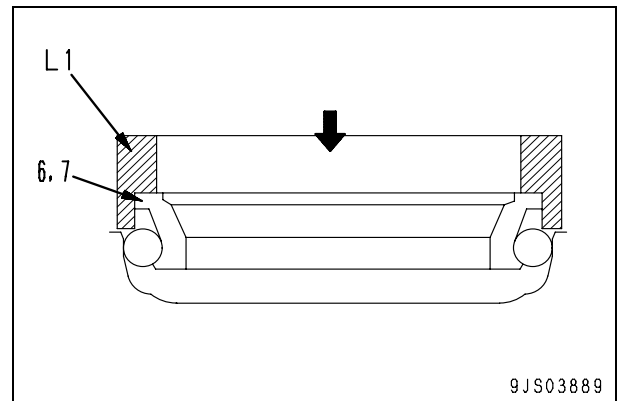
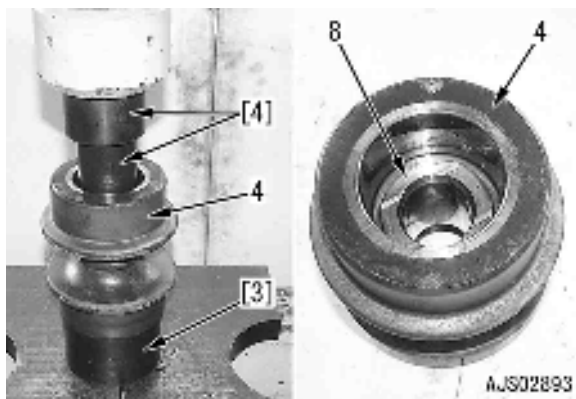
6. Using push tools [2] and [3], remove bushing (8) from roller (4).



Assembly

1. Using push tools [3] and [4], press fit bushing (8) to roller (4).

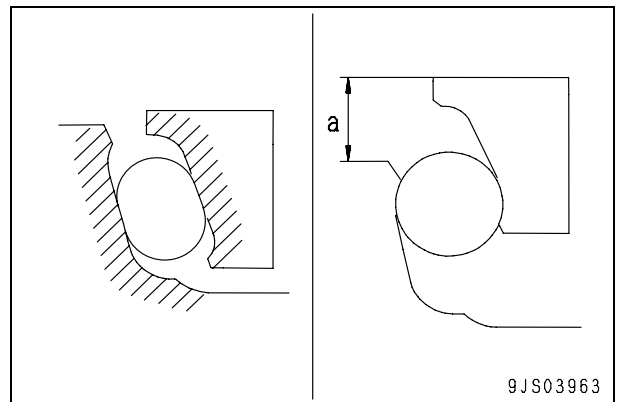
★ Press it from the side of cover (3)



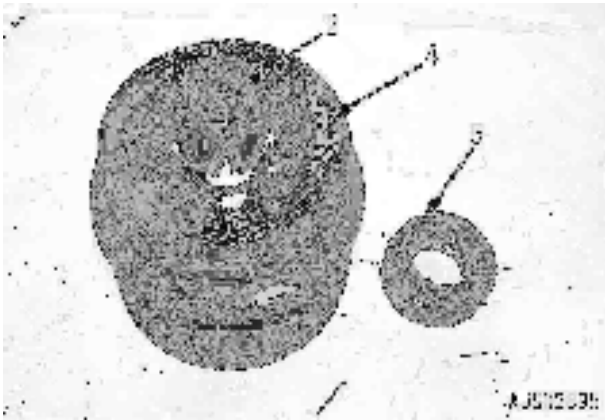
2. floating seal

- 1) Using tool L1, install floating seal (7) to roller (4).
- 2) Using tool L1, install floating seal (6) to roller (5).

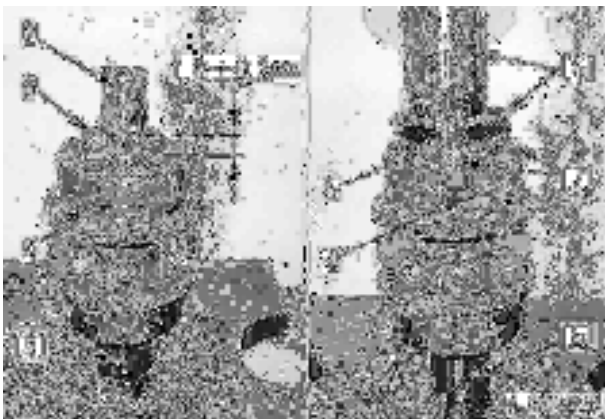
- ★ When installing the floating seal, completely wash and degrease and dry both O-ring and the surfaces where the O-ring and the floating seal will contact each other (hatched in the sketch). And take care that there is no dust sticking on the contact surface of floating seal.
- ★ When fitting the floating seal, use a tool L1 and be sure that the O-ring is pushed during the insertion.
- ★ After inserting the floating seal, verify that the inclination of the seal is less than 1 mm per its diameter and that the protrusion height of the seal shown as a in the illustration falls within the range of 7 – 11 mm.



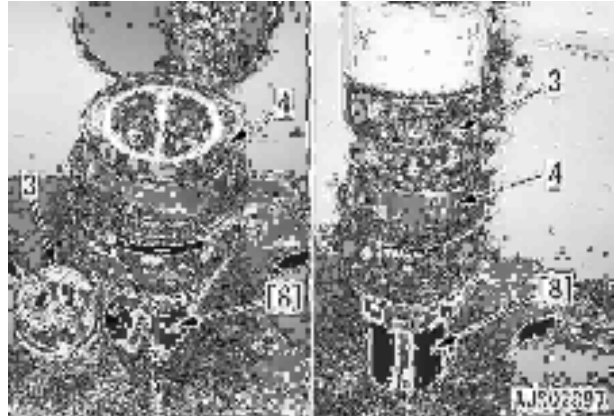
3. Install roller (4) and ring (5) to shaft (2).
 ★ On the sliding surfaces of floating seals, apply some oil and take care not to have any dirt stuck on them.



4. To make the height gap between roller (4) and ring (5) 1.8 ± 0.2 mm, put washer [7] between push tool [6] and roller (4), then press fit ring (5) to shaft (2).
 ★ The thickness of washer [7] is 1.8 ± 0.2 mm.
 ★ Use push tool [5] to support shaft (2) on it.

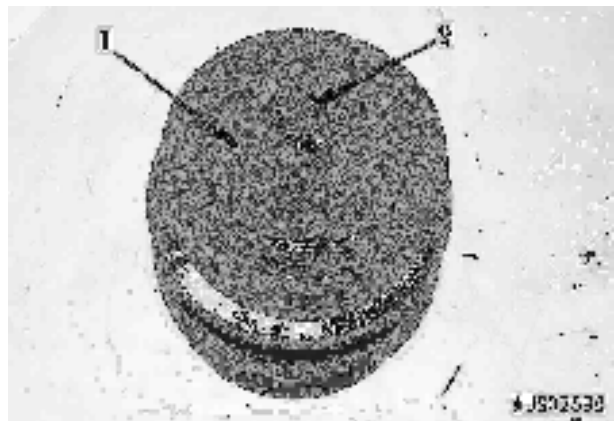


5. Using push tool [8], press fit cover (3) to roller (4).
 ★ Degrease, wash and dry the surfaces where roller (4) and cover (3) fit tight.
 ● Press fitting force (reference):
 59 kN {6,000 kg} Min



6. Fill carrier roller assembly (1) with oil and tighten plug (9).

Carrier roller: 75 – 85cc (E030-CD)
 Plug: 15 ± 5 Nm { 1.5 ± 0.5 kgm}



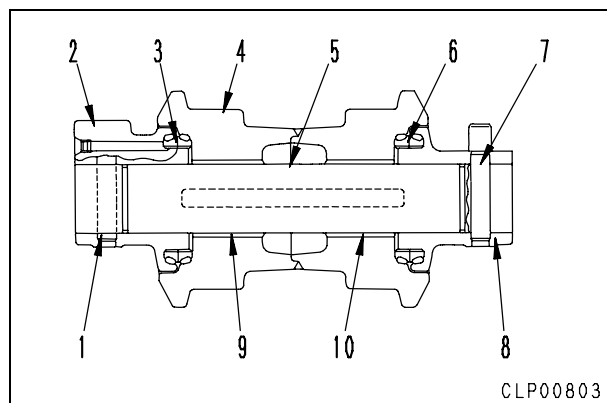
Disassembly and assembly of track roller assembly

Special tools

Symbol	Part No.	Part name	Necessity	Qty	New/Remodel	Sketch
L 2	796-670-1020	Installer	■	1		

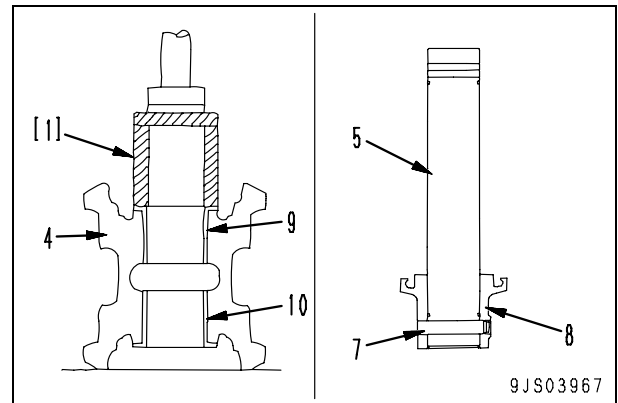
Disassembly

1. Remove pin (1) and then collar (2).
2. Remove floating seal (3) from collar (2) and roller (4).
3. Pull out roller (4) from shaft (5) and collar (8) assembly.
★ Since 195 cc of oil is filled in, drain it at this timing, or underlay some cloth to prevent any careless smearing.
4. Pull out other side floating seal (6) from roller (4), shaft (5) and collar (8) assembly.
5. Remove pin (7) and then collar (8) from shaft (5).
6. Remove bushing (9) and (10) from roller (4).



Assembly

1. Using push tool [1], press fit bushing (9) and (10) to roller (4).
2. Fit an O-ring and install collar (8) to shaft (5), and insert pin (7).

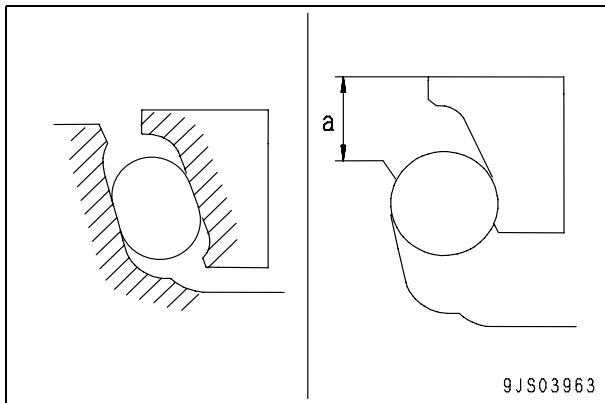
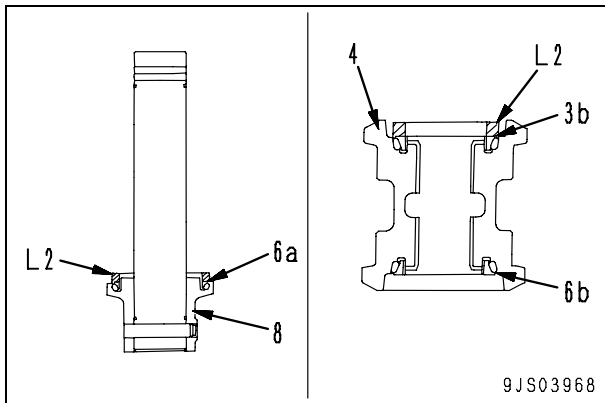


3. Using tool **L2**, install floating seal (6a) to collar (8).

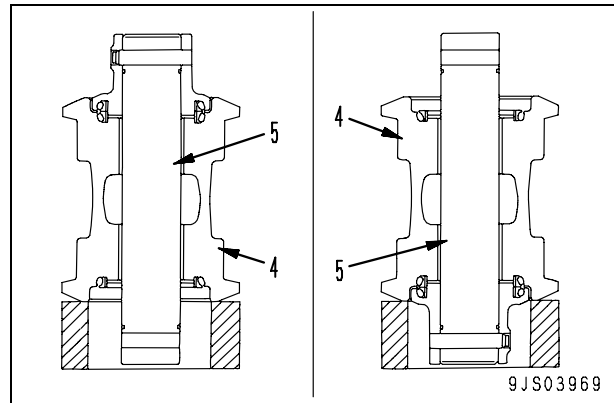
- ★ When installing the floating seal, completely wash, degrease and dry both O-ring and the surfaces of floating seal where they contact each other (shown hatched in the illustration). And take care that there is no dust sticking on the contact surfaces of floating seal.
- ★ After inserting the floating seal, verify that the inclination of the seal is less than 1 mm per its diameter and that the protrusion height shown as **a** in the illustration falls within the range of 7 – 11 mm.

4. Using tool **L2**, install floating seals (6b) and (3b) to roller (4).

- ★ As to notes for installation of floating seals (6b) and (3b), refer to ★ marked comments in the section 3.



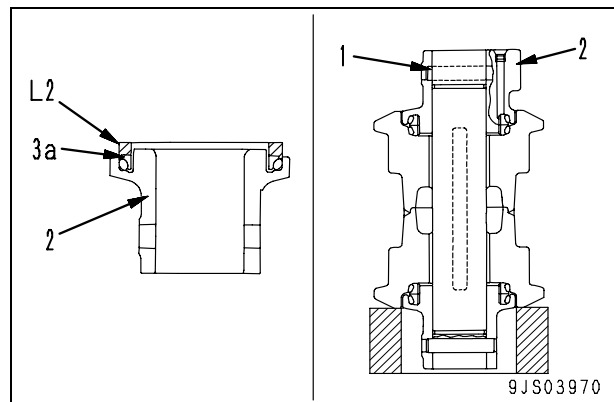
5. Install shaft (5) to roller (4).
6. Put roller (4) and shaft (5) assembly up side down.



7. Using tool **L2**, install floating seal (3a) to collar (2).

- ★ As to notes for installation of floating seal (3a), refer to ★ marked comments in the section 3.
- ★ On the sliding surfaces of the floating seals, apply some oil and take care not to have any dust stuck on them.

8. Fit an O-ring and install collar (2) to the shaft with pin (1).



9. Add oil and tighten the plug.

- Amount of oil: **190 – 200 cc (E030-CD)**
- Plug: **15 ± 5 Nm {1.5 ± 0.5 kgm}**

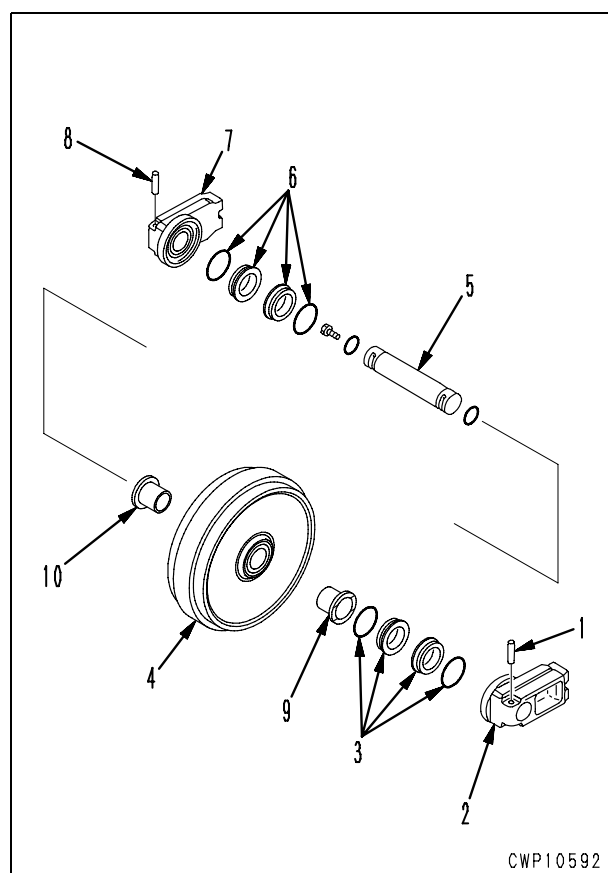
Disassembly and assembly of idler assembly

Special tools

Symbol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
L 3	791-530-1510	Installer	■	1		

Disassembly

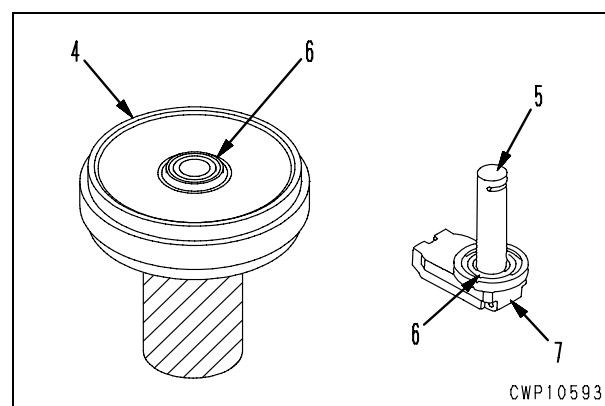
- Structural illustration



1. Remove the dowel pin (1) to dismount the support (2).
2. Remove the floating seal (3) from the support (2) and idler (4).

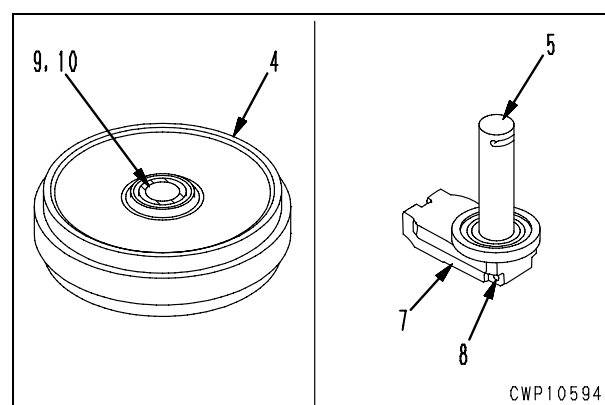
3. Detach idler the (4) from shaft (5) and support assembly (7).
 - ★ Since 250cc of oil is filled in, drain it at this timing, or underlay some cloth to prevent any careless smearing.

4. Remove floating seal (6) on the opposite side from idler (4), shaft (5) and support assembly (7).



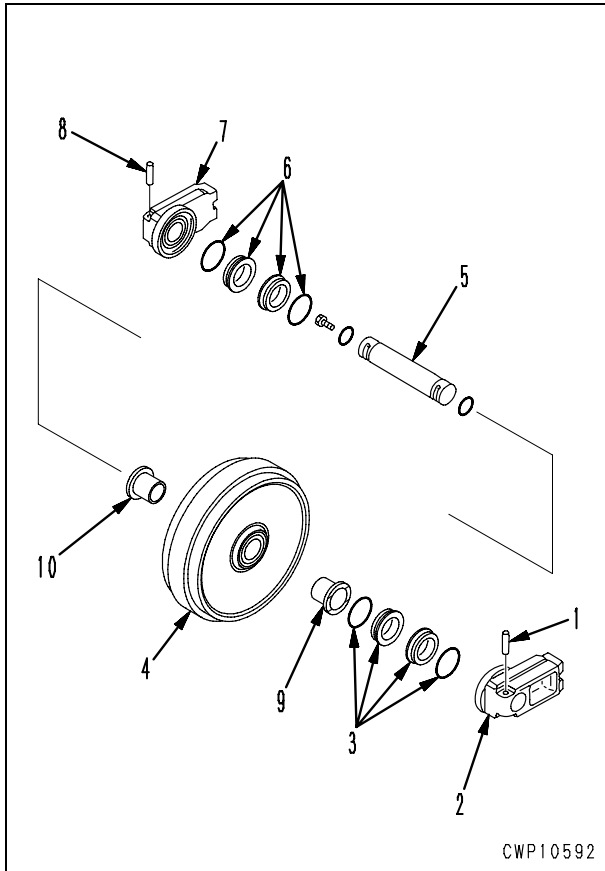
5. Remove dowel pin (8) to detach support (7) from shaft (5).

6. Remove bushings (9) and (10) from idler (4).

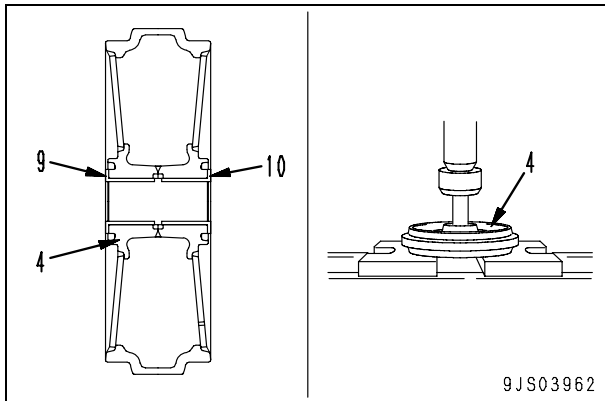


Assembly

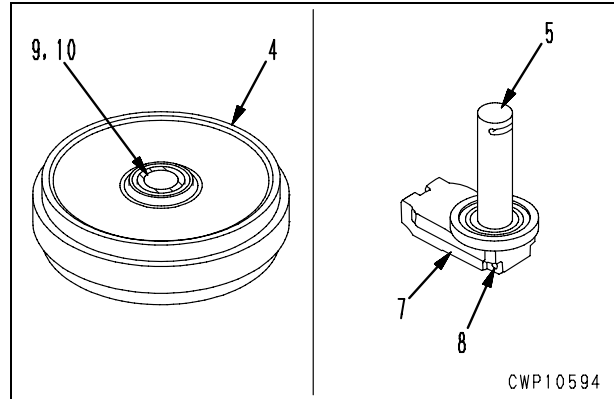
- Structural illustration



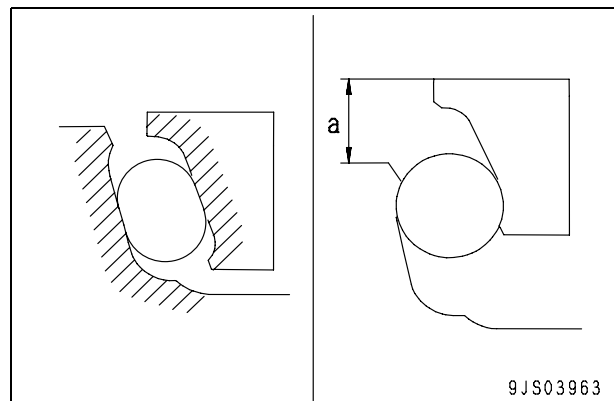
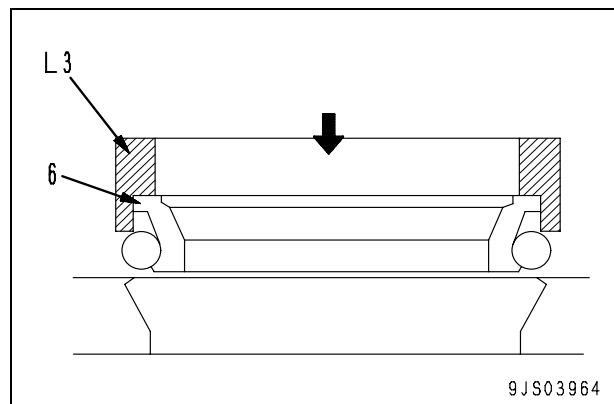
1. Press fit bushings (9) and (10) to idler (4).



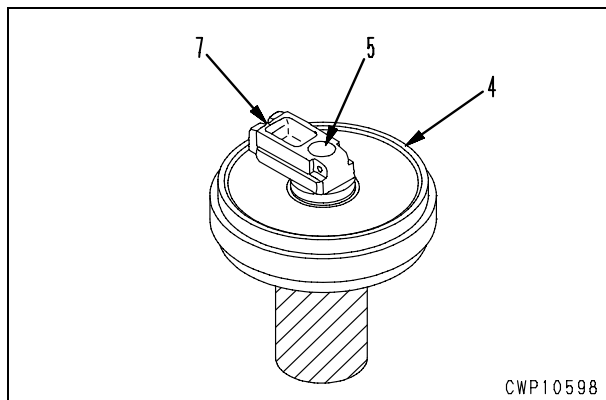
2. Fit an O-ring and install support (7) to shaft (5) with dowel pin (8).



3. Using tool **L3**, install floating seals (6) to idler (4) and to shaft (5) and support (7) assembly.
 - ★ Completely wash, degrease and dry both O-rings and the surfaces (shown hatched in the illustration) of floating seals where they contact each other.
 - ★ Coat the sliding surface of the floating seal with oil, and be careful not to let any dirt or dust get stuck to it.
 - ★ After inserting the floating seal, verify that the inclination of the seal is less than 1 mm per its diameter and that the protrusion height shown as **a** in the illustration falls within the range of 7 – 11 mm.



4. Assemble shaft (5) and support (7) assembly to idler (4).



6. Fit an O-ring and install support (2) to the shaft with dowel pin (1).
★ See structural illustration.

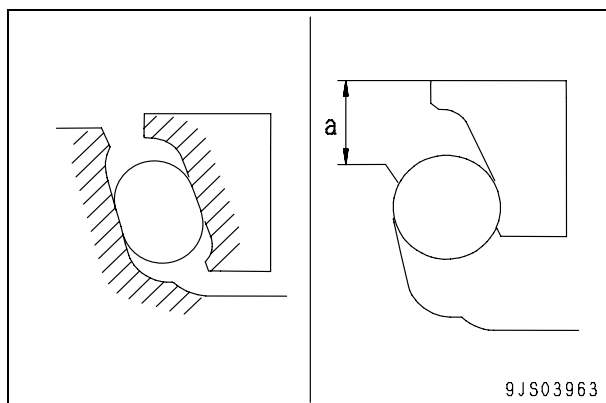
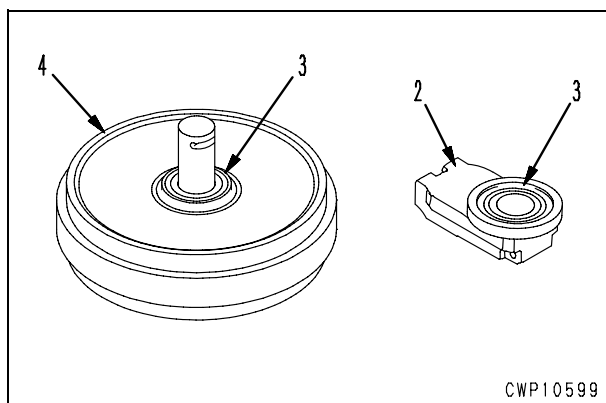
7. Add oil and tighten the plug.

Amount of oil: **245 – 255 cc (E030-CD)**

Plug: **205.8 ± 49 Nm {21 ± 5 kgm}**

5. Using tool **L3**, install floating seals (3) to idler (4) and to support (2).

- ★ Completely wash, degrease and dry both O-rings and the surfaces (shown hatched in the illustration) of floating seals where they contact each other.
- ★ Coat the sliding surface of the floating seal with oil, and be careful not to let any dirt or dust get stuck to it.
- ★ After inserting the floating seal, verify that the inclination of the seal is less than 1 mm per its diameter and that the protrusion height shown as (a) in the illustration falls within the range of 7 – 11 mm.



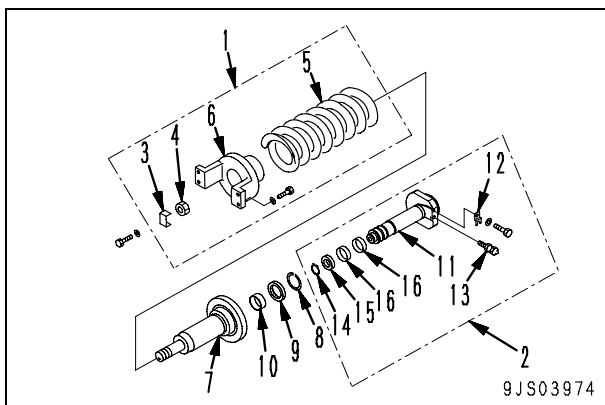
Disassembly and assembly of recoil spring

Special tools

Sym- bol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
J	1	791-600-2001 Compressor (A) or 791-685-8006 Compressor (B)	■	1		
		790-201-2780 Spacer				
	1	791-635-3160 Extension	■	1		
		790-101-1600 Cylinder (686kN{70ton})	■	1		
		790-101-1102 Pump	■	1		
		790-640-2180 Guide bolt	■	1		
	2	790-101-5201 Push tool kit (B)	●	1		
		790-101-5241 • Plate		1		
		790-101-5221 • Grip		1		
		01010-51225 • Bolt		2		
	3	790-201-1500 Push tool kit	●	1		
		790-201-1620 • Plate		1		
		790-101-5021 • Grip		1		
		01010-50816 • Bolt		1		

Disassembly

- Structural illustration



1. Remove piston assembly (2) from recoil spring assembly (1).

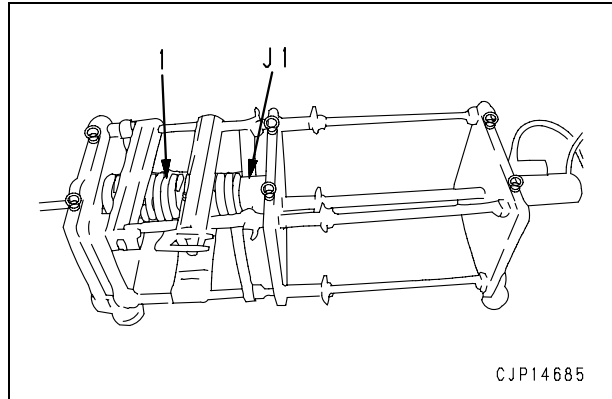
2. Disassembly of recoil spring assembly

- 1) Set tool J1 to recoil spring assembly (1)

⚠ Since the recoil spring will be pressed to a high installation load, be very sure to set the tool properly to prevent any risk.

★ Installation load:

109.2 kN {11,150 kg}



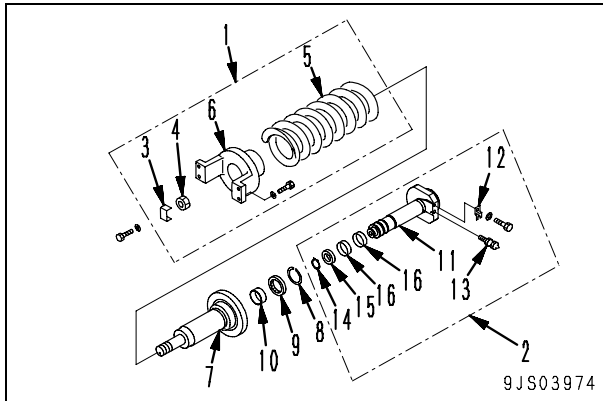
- 2) Apply hydraulic pressure gradually to remove lock plate (3) then nut (4).
 - ★ Compress the spring up to the point where the nut gets loose.
 - ★ Release the hydraulic pressure slowly and release the tension of the spring.
 - ★ Free length of spring: **531 mm**
- 3) Remove yoke (6) and cylinder (7) from spring (5).
- 4) Remove snap ring (8), dust seal (9) and bushing (10), one after the other, from cylinder (7).

3. Further disassembly of piston assembly(2)

- 1) Remove lock plate (12) from piston (11), and then valve (13).
- 2) Remove snap ring (14), and then U-packing (15) and ring (16).

Assembly

- Structural illustration

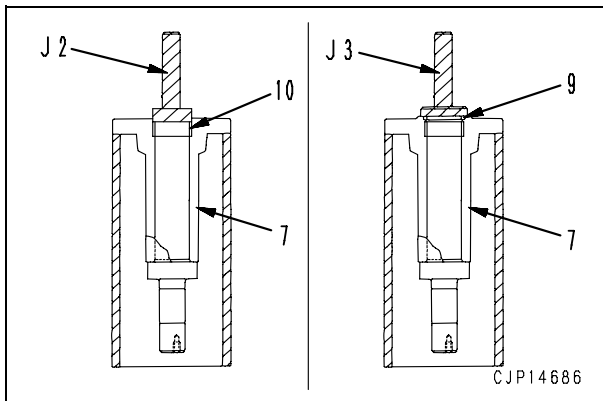


1. Assembly of piston assembly(2)

- 1) Assemble ring (16) and U-packing (15) to piston (11), and secure them with snap ring (14).
- 2) Tighten valve (13) temporarily, and secure it with lock plate (12).

2. Disassembly of recoil spring assembly

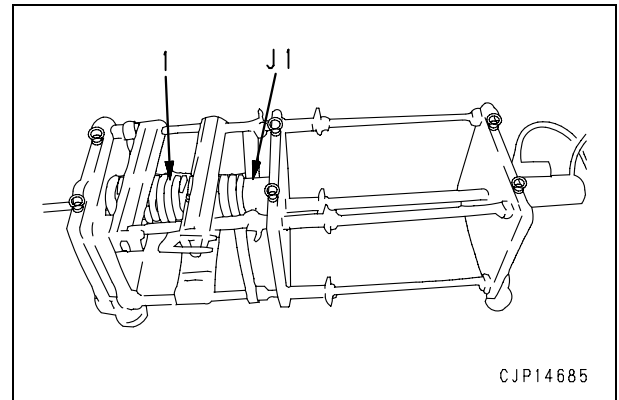
- 1) Using tool J2, press fit bushing (10) to cylinder (7).
- 2) Using tool J3, assemble dust seal (9) to cylinder (7).
- 3) Secure them with snap ring (8).



- 4) Assemble cylinder (7) and yoke (6) to spring (5), and set them to tool J1.

Sliding portion of cylinder:

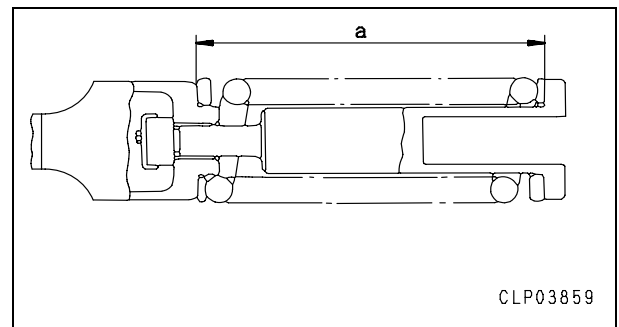
Grease (G2-LI)



- 5) Apply hydraulic pressure slowly to compress the spring, and then tighten nut (4) so that the installed length of the spring is dimension (a) and secure it with lock plate (3).

★ Installed length of spring (a) :

417 mm



- 6) Remove recoil spring assembly (1) from tool J1 .

3. Assemble piston assembly (2) to recoil spring assembly (1).

Sliding portion of cylinder:

Grease (G2-LI)

Wear ring: **Grease (G2-LI)**

- ★ Install the piston assembly so the valve installing position is on the outside.
- ★ Fill the cylinder with 300cc of grease (G2-LI), purging air, and see the grease comes out of the grease hole.

Expansion and installation of track shoe assembly

Special tools

Sym- bol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
M	791-630-3000	Remover and installer	■	1		
	790-101-1300	Cylinder	■	1		
	790-101-1102	Pump	■	1		
	790-331-1110	Wrench	■	1		

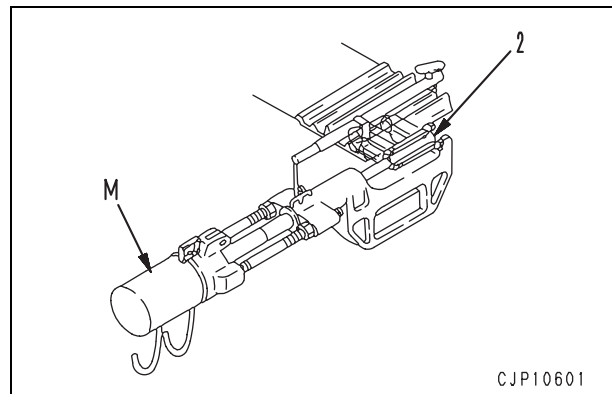
Expansion

1. Stop the machine so that the master pin will be between the idler and carrier roller and the track shoe can be expanded in the forward and backward directions.
2. Lower the work equipment to the ground and loosen lubricator (1) to slacken the track shoe. [*1]

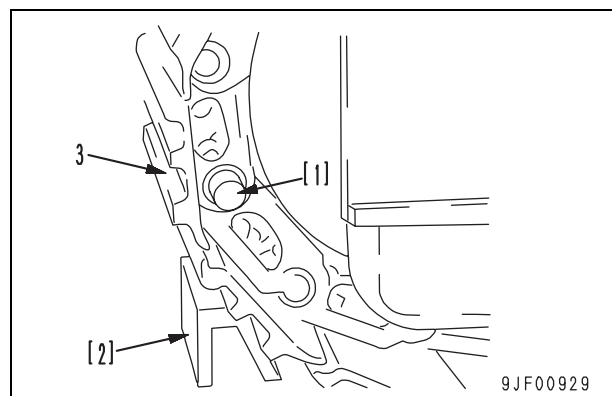
⚠ Since the internal pressure of the adjustment cylinder is very high, do not loosen the lubricator more than 1 turn. If the grease does not come out sufficiently, move the machine forward and in reverse.



3. Using tool **M**, pull out master pin (2). [*2]



4. Remove tool **M** and move the machine forward so that temporary pin [1] will be in front of the idler, then set block [2].
5. Pull out temporary pin [1] and remove the dust seal. Move the machine in reverse to expand track shoe (3). [*3]

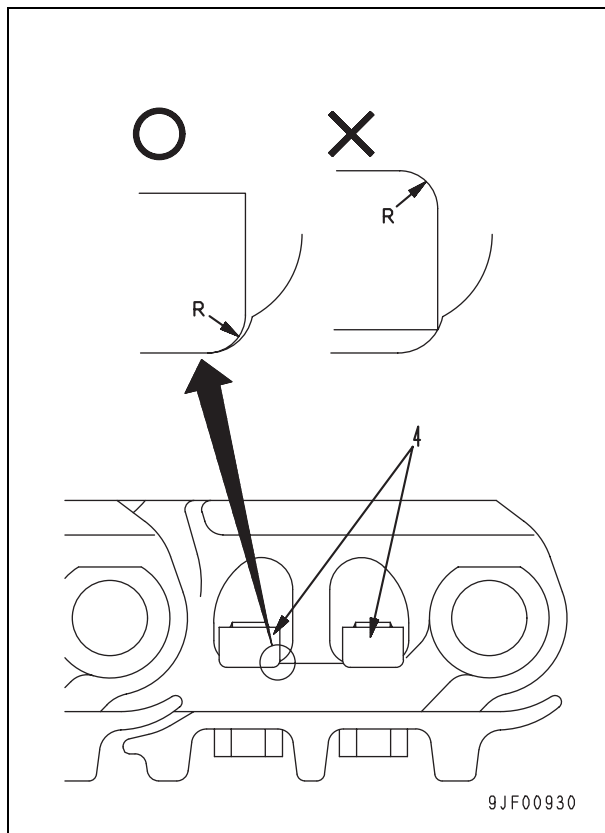


Installation

- Carry out installation in the reverse order to removal.

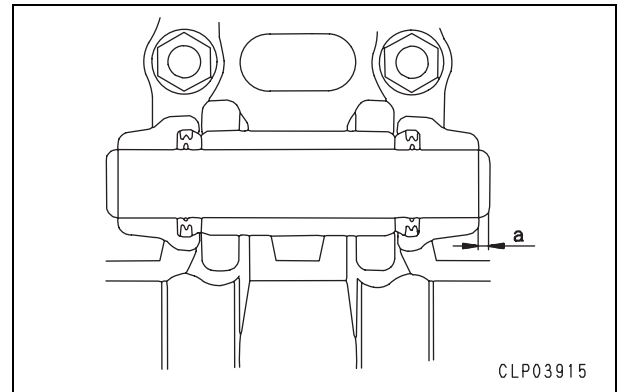
[*1]

- ★ Adjust the tension of the track shoe. For detail, see Testing and adjusting, "Inspection and adjustment of track shoe tension".
- Procedure for tightening shoe bolts and nuts
 1. Install each shoe nut (4) so that its rounded side (R) will be fitted to the seat on the link side.
 - ★ If the shoe nut is installed reversely, its corner will interfere with the seat on the link side and it will not be fitted to the seat, and that can loosen the bolt.
 2. Tighten the bolt.
 - ★ Check that the mating faces are fitted and re tighten the bolt.
 - 🔧 1st time: **$490 \pm 50 \text{ Nm}$ { $50 \pm 5 \text{ kgm}$ }**
 - 2nd time: **$120^\circ \pm 10^\circ \text{ Nm}$**
(Angle tightening)



[*2]

- ★ Using tool **M**, press fit the master pin so that its projection (a) will be as follows.
 - Dimension (a): **$2.5 \pm 1 \text{ mm}$**



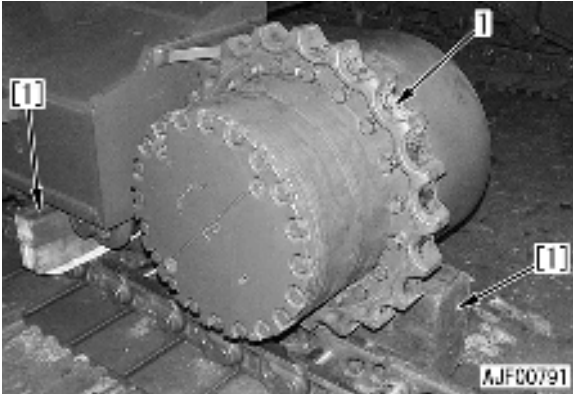
[*3]

- ★ When fitting the dust seal, apply grease (G2-LI) to its contact face against the bushing.


Removal and installation of sprocket

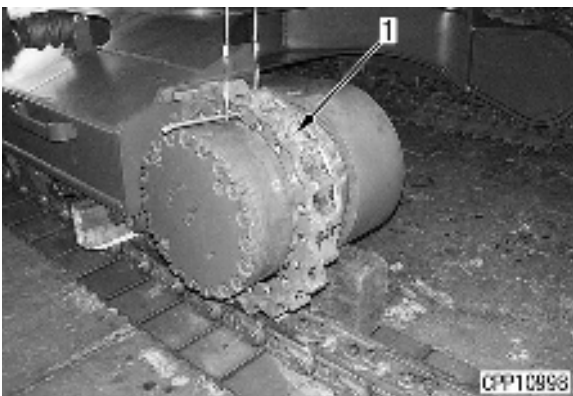
Removal

1. Expand the track shoe assembly. For details, see Expansion of track shoe assembly.
2. Swing the work equipment by 90 ° and push up the machine with it, and then set blocks [1] between the track frame and track shoe.



3. Remove the 20 mounting bolts and lift off sprocket (1). [*1]

 Sprocket: **40 kg**



Installation

- Carry out installation in the reverse order to removal.

[*1]



Threads of sprocket mounting bolt:

Adhesive (LT-2)



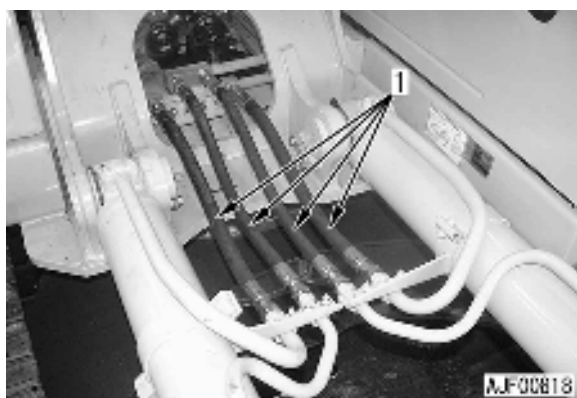
Sprocket mounting bolt:

441 – 490 Nm {45 – 50 kgm}

Removal and installation of revolving frame assembly

Removal


1. Remove the work equipment assembly. For details, see Removal and installation of work equipment.
2. Remove the counterweight assembly. For details, see Removal and installation of counterweight.
3. Remove the engine hood.
4. Remove the plate from the rear of the engine compartment (between the engine compartment and counterweight).
 - ★ Move or remove other parts which may interfere with the sling of the revolving frame assembly.
5. Disconnect 4 hoses (1).

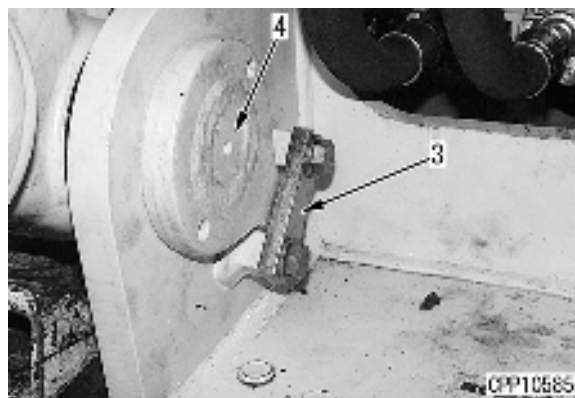


6. Sling boom cylinder assembly (2) temporarily.

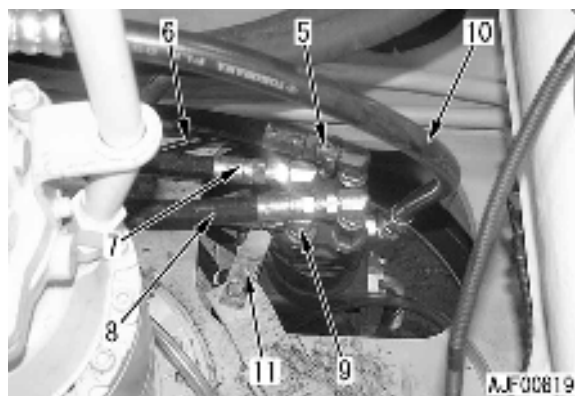


7. Remove plate (3) and pin (4) and lift off boom cylinder assembly.
 - ★ Remove the boom cylinder on the opposite side simultaneously.

 Boom cylinder assembly: **130 kg**



8. Disconnect 6 hoses (5) – (10) above the swivel joint assembly.
 - ★ Put tags to the disconnected hoses and tubes to prevent a mistake in re-connecting them.
 - ★ For detail of the routes of the hoses, see removal and installation of swivel joint assembly.
9. Pull out the pin on the centre swivel joint side and disconnect plate (11) from the swivel joint.



10. Remove the 32 mounting bolts and lift off revolving frame assembly (12). [*1]

★ Using a lever block, etc., balance the revolving frame assembly in longitudinal and lateral directions, and then remove the all mounting bolts, except the 2 each on the front and rear sides.

⚠ **When removing the revolving frame assembly, take care that it will not interfere with the centre swivel joint assembly.**



Revolving frame assembly:

3,050 kg



Installation

- Carry out installation in the reverse order to removal.

[*1]



Mating face of swing circle:

Gasket sealant (LG-1)



Threads of revolving frame mounting bolt:

Adhesive (LT-2)



Revolving frame mounting bolt:

1st time: **294.2 – 29.4 Nm {30 – 3 kgm}**

2nd time: **Re tighten by 60 ° or**

588 – 677 Nm {60 – 69 kgm}

- **Refilling with oil (Hydraulic tank)**
 - ★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.
- **Bleeding air**
 - ★ Bleed air. For details, see Testing and adjusting, "Bleeding air from each part".

Removal and installation of counterweight

Removal

1. Set eyebolts [1] to counterweight assembly (1) and sling the counterweight assembly temporarily.
2. Remove 4 mounting bolts (2). [*1]
3. Lift off counterweight assembly (1).
 - ★ Take care not hit the counterweight against the engine. [*2]



PC160LC Counterweight **2,900 kg**



PC180LC/NLC Counterweight **3,600 kg**



Installation

- Carry out installation in the reverse order to removal.

[*1]



Threads of mounting bolt: **Adhesive (LT-2)**



Mounting bolt:

2,160 – 2,450 Nm {220 – 250 kgm}

[*2]

- ★ Install the counterweight so that the clearance between it and the revolving frame and the clearance between it and exterior door will be 10 ± 5 mm on each side.

PC160LC-7E0, PC180LC/NLC-7E0 Hydraulic Excavator

Form No. UEN02450-00

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HYDRAULIC EXCAVATOR

PC160LC-7E0

PC180LC-7E0

PC180NLC-7E0

Machine model	Serial number
---------------	---------------

PC160LC-7E0	K45001 and up
PC180LC-7E0	K45001 and up
PC180NLC-7E0	K45001 and up

50 Disassembly and assembly

Hydraulic system

Removal and installation of centre swivel joint assembly	2
Disassembly and assembly of centre swivel joint assembly	4
Removal and installation of hydraulic tank assembly	5
Removal and installation of hydraulic pump assembly	8
Removal and installation of control valve assembly	11
Disassembly and assembly of control valve assembly	15
Removal and installation of hydraulic pump input shaft oil seal	17
Disassembly and assembly of work equipment PPC valve assembly	18
Disassembly and assembly of travel PPC valve assembly	19
Disassembly and assembly of hydraulic cylinder assembly	20
Disassembly and Assembly of Quick Coupler Valve	26

Removal and installation of centre swivel joint assembly

Removal

⚠ **Release the residual pressure in the hydraulic circuit. For details, see Testing and adjusting, "Release of residual pressure from hydraulic circuit".**

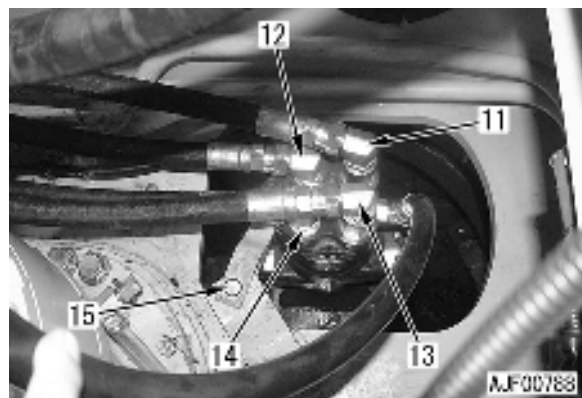
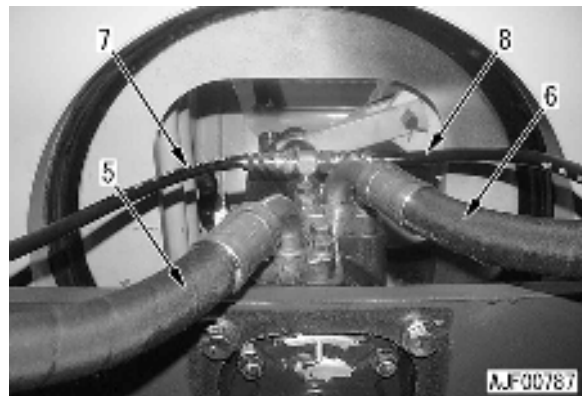
★ Put tags to the disconnected hoses and tubes to prevent a mistake in re-connecting them.

1. Disconnect 14 hoses (1) – (14).


★ Hose (9) may be disconnected from the swing motor.

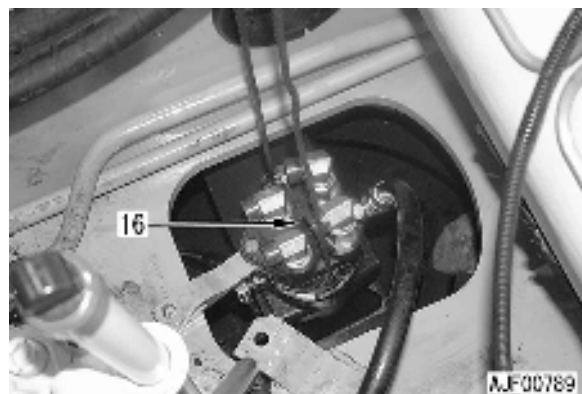
- (1) : Between centre swivel joint (Port DR) and left travel motor (Port T)
- (2) : Between centre swivel joint (Port DR) and right travel motor (Port T)
- (3) : Between centre swivel joint (Port B) and right travel motor (Port PB)
- (4) : Between centre swivel joint (Port D) and left travel motor (Port PA)
- (5) : Between centre swivel joint (Port A) and right travel motor (Port PA)
- (6) : Between centre swivel joint (Port C) and left travel motor (Port PB)
- (7) : Between centre swivel joint (Port E) and left travel motor (Port P)
- (8) : Between centre swivel joint (Port E) and right travel motor (Port P)
- (9) : Between centre swivel joint (Port DR) and swing motor (Port DB)
- (10) : Between centre swivel joint (Port E) and solenoid valve
- (11) : Between centre swivel joint (Port B) and control valve right travel (Port B2)
- (12) : Between centre swivel joint (Port D) and control valve left travel (Port B3)
- (13) : Between centre swivel joint (Port A) and control valve right travel (Port A2)
- (14) : Between centre swivel joint (Port C) and control valve left travel (Port A3)

2. Remove pin (15).



3. Remove the 4 mounting bolts and lift off centre swivel joint assembly (16). [*1]

 Centre swivel joint assembly: **40 kg**

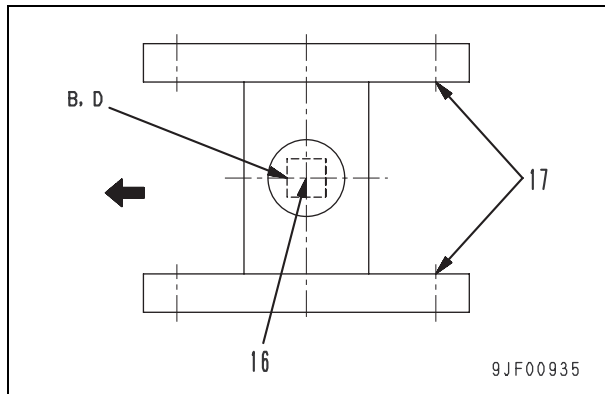


Installation

- Carry out installation in the reverse order to removal.

[*1]

- ★ When installing centre swivel joint assembly (16), set ports (B) and (D) toward the front of the machine (in the direction of the arrow). [(17) in the following figure indicates the sprocket.]



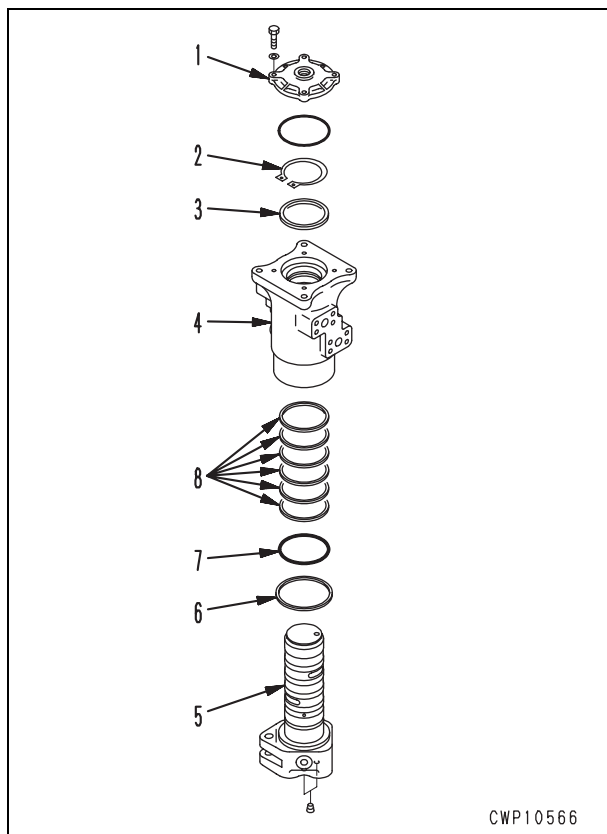
- **Refilling with oil (Hydraulic tank)**
 - ★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.
- **Bleeding air**
 - ★ Bleed air. For details, see Testing and adjusting, "Bleeding air from each part".

Disassembly and assembly of centre swivel joint assembly

Special tools

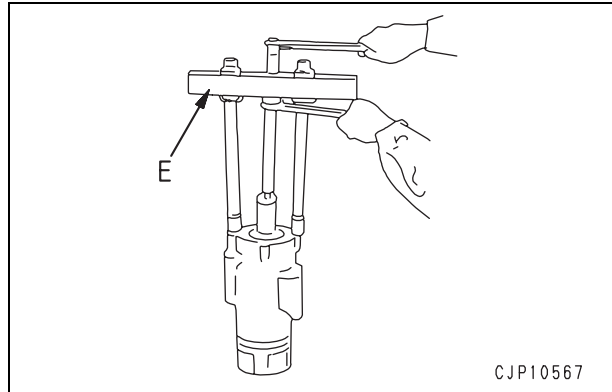
Sym-bol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
E	790-101-2501	Push puller	●	1		
	790-101-2510	• Block		1		
	790-101-2520	• Screw		1		
	791-112-1180	• Nut		1		
	790-101-2540	• Washer		1		
	790-101-2630	• Leg		2		
	790-101-2570	• Plate		4		
	790-101-2560	• Nut		2		
	790-101-2650	• Adapter		2		

Disassembly





1. Remove cover (1).
2. Remove snap ring (2).

3. Using tool **E**, pull out swivel rotor (4) and ring (3) from swivel shaft (5).
4. Remove seal (6) from swivel shaft (5).
5. Remove O-ring (7) and slipper seal (8) from swivel rotor (4).



Assembly


1. Assemble slipper seal (8) and O-ring (7) to swivel rotor (4).
2. Assemble seal (6) in swivel shaft (5).
3. Set swivel shaft (5) to block, then using push tool, tap swivel rotor (4) with a plastic hammer to install.
 Contact surface of rotor, shaft:
Grease (G2-LI)
 ★ When installing the rotor, be extremely careful not to damage the slipper seal and the O-ring.
4. Install ring (3) and secure with snap ring (2).
5. Fit O-ring and install cover (1).
 Mounting bolt:
31.4 – 2.9Nm {3.2 – 0.3 kgm}

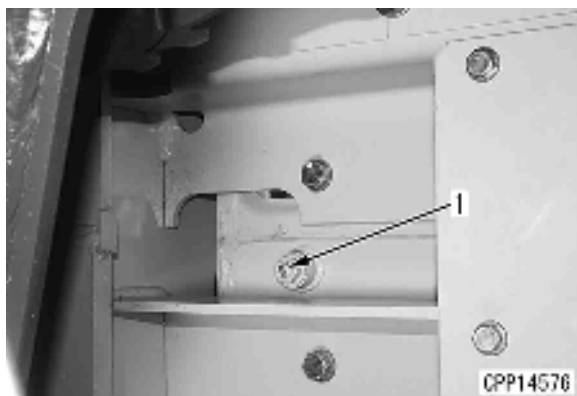
Removal and installation of hydraulic tank assembly

Removal

- ⚠ **Stop the machine on a level ground, lower the work equipment to the ground, stop the engine, and set the lock lever in the lock position.**
- ⚠ **Disconnect the cable from the negative (–) terminal of the battery.**
- ⚠ **Loosen the hydraulic tank cap gradually to release the residual pressure in the hydraulic tank.**

1. Loosen hydraulic oil drain plug (1) to drain the work equipment oil. [*1]

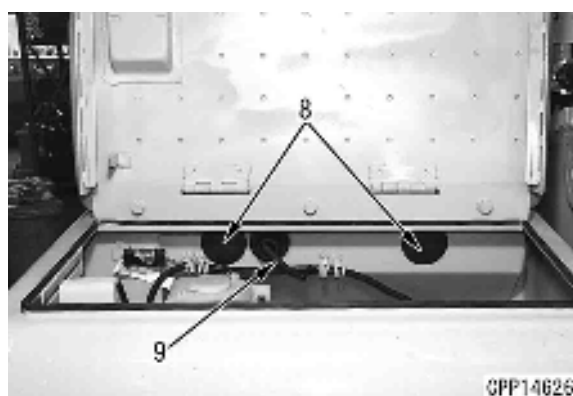
 Hydraulic tank: 167 ℓ



2. Removal of handrail (2)
 - 1) Remove 4 mounting bolts (3) at the top of the engine compartment.
 - 2) Remove the 2 mounting bolts in tool case (4) and remove handrail (2).



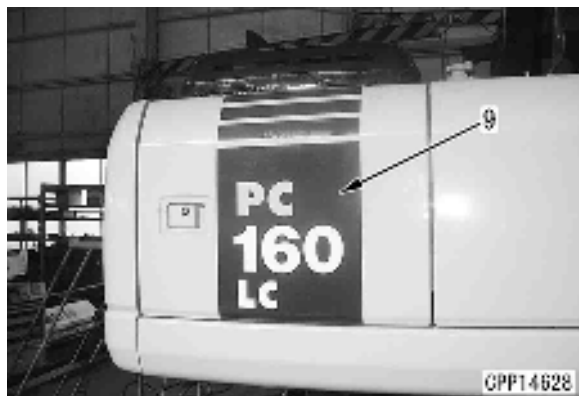
3. Removal of cover (5)
 - 1) Remove 2 mounting bolts (6) which are mounting the cover to the engine compartment top.
 - 2) Open cover (7) of tool case (4), remove 2 rubber caps (8) on the right and left sides.
 - 3) Remove the 2 lower mounting bolts of cover (5).
 - 4) Remove cover (5).
4. Disconnect fuel level sensor wiring connector (9).



5. Remove 4 mounting bolts of tool case (4) and move the tool case forward.



6. Remove cover (9).



7. Remove cover (10) and plates (11) and (12).



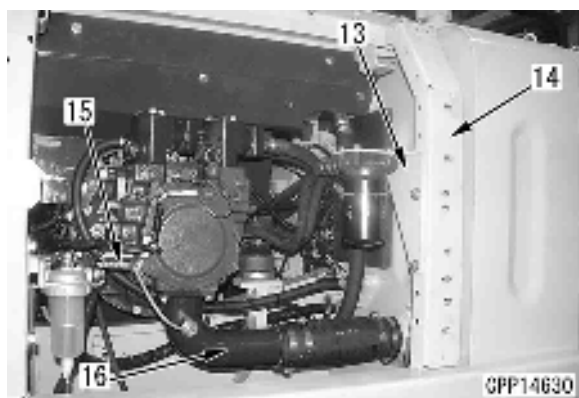
8. Remove the mounting bolts of oil filter bracket (13) and frame (14).

9. Disconnect connector P22 (15).

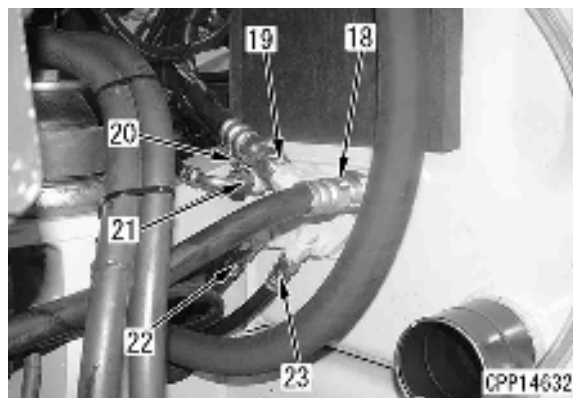
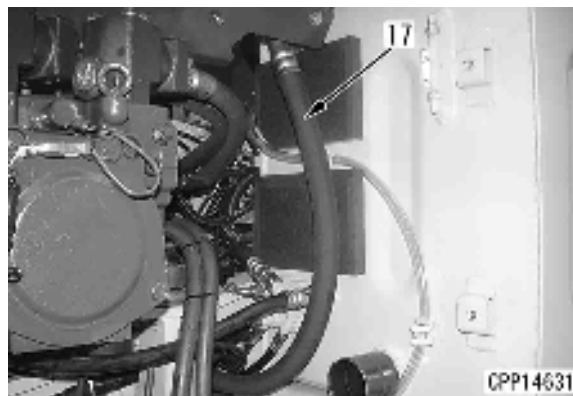
10. Remove suction tube and hose assembly (16).

[*2]

★ Prepare a container to receive oil.



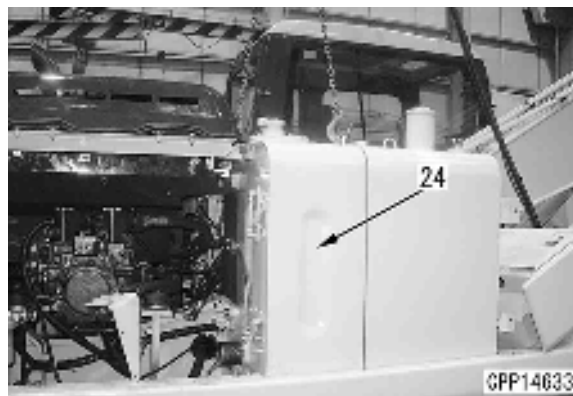
11. Disconnect 7 hoses (16) – (23).



12. Remove the undercover and 6 lower mounting bolts and lift off hydraulic tank assembly (24).

[*3]

Hydraulic tank assembly: **120 kg**



Installation

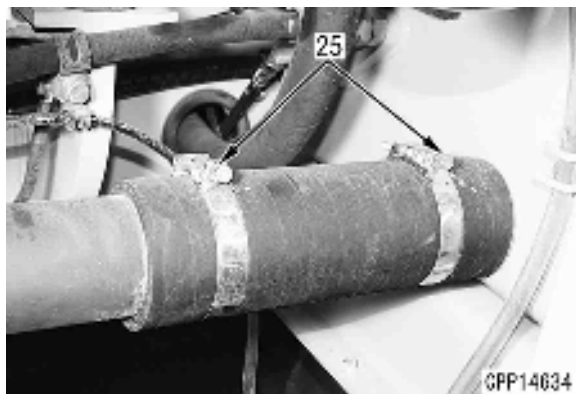
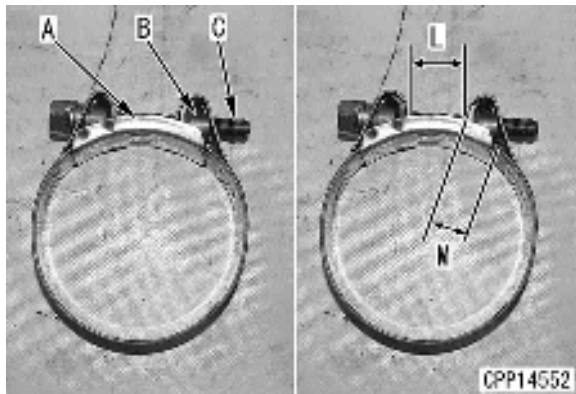
- Carry out installation in the reverse order to removal.

[*1]

- Hydraulic tank drain plug:
58.8 – 78.5 {6.0 – 8.0 kgm}

[*2]

- ★ Procedure for installing MIKALOR clamp (25)
 - When tightening the clamp, apply the following lubricating oil or equivalent to its threaded part [C].
Lubricating oil: Threebond (PANDO 18B)
 - Adjust bridge [A] so that it will be under band [B].
 - Tighten until dimensions [L] and [M] are set to the specified dimensions.
Dimension L
Between aftercooler and air intake connector:
Aftercooler side: 10 (+0/-3) mm
Air intake connector side:
20 (+0/-3) mm
Between aftercooler and turbocharger connector: 10 (0/-3) mm
Dimension M: Min. 5 mm
 - If the tightened dimensions are out of the above ranges, replace the clamp with new one.
 - Do not use an impact wrench.



[*3]

- Mounting bolt:
245.2 – 308.9 Nm {25 – 31.5 kgm}

Refilling with oil (Hydraulic tank)

- ★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

Hydraulic tank: **167 ℓ (EO10-CD)**

Bleeding air

- Bleed air. For details, see Testing and adjusting, "Bleeding air from each part".

Removal and installation of hydraulic pump assembly

Special tools

Sym-bol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
D	796-460-1210	Oil stopper	●	1		
	796-770-1320	Adapter	●	1		

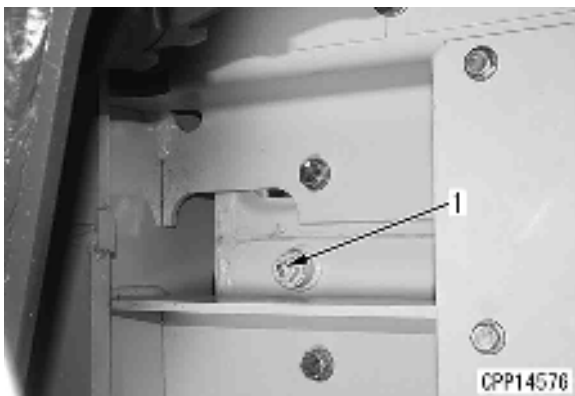
Removal

- ⚠ Stop the machine on a level ground, lower the work equipment to the ground, and stop the engine.
- ⚠ Loosen the hydraulic tank cap gradually to release the residual pressure in the hydraulic tank and set the lock lever in the lock position.
- ⚠ Disconnect the cable from the negative (–) terminal of the battery.

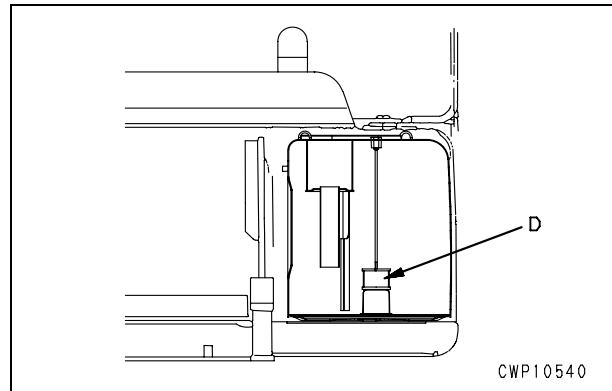
★ Put tags to the disconnected piping to prevent a mistake in re-connecting them.

1. Loosen hydraulic oil drain plug (1) to drain the work equipment oil. [*1]

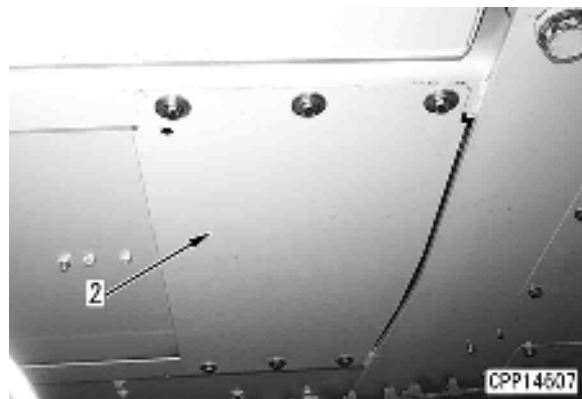
 Hydraulic tank: **167 ℓ**




- ★ When using tool **D**, remove the hydraulic tank strainer and stop the oil with tool **D**.



2. Remove undercover (2).



3. Loosen drain plug (3) to drain the damper oil.

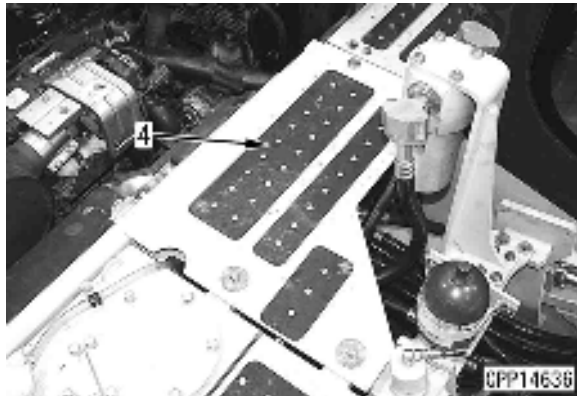
 Damper case: **0.85 ℓ**



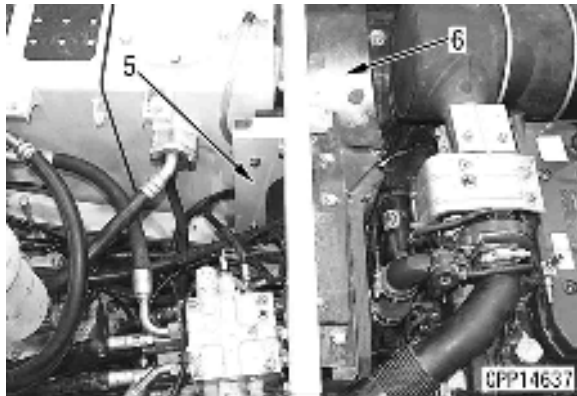
4. Remove the engine hood.
For details, see "Removal and installation of engine hood".

5. Removal of covers

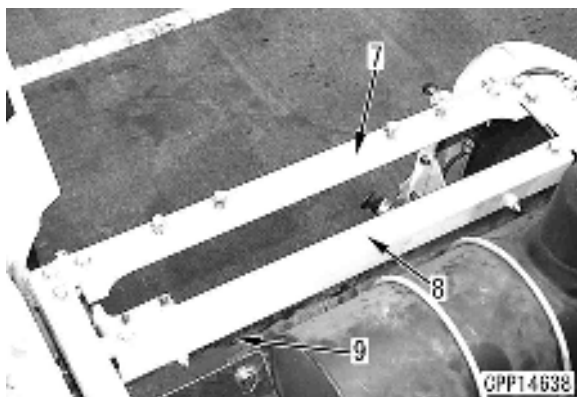
- 1) Remove step plate (4).



- 2) Remove plate (5).
- 3) Remove cover (6).

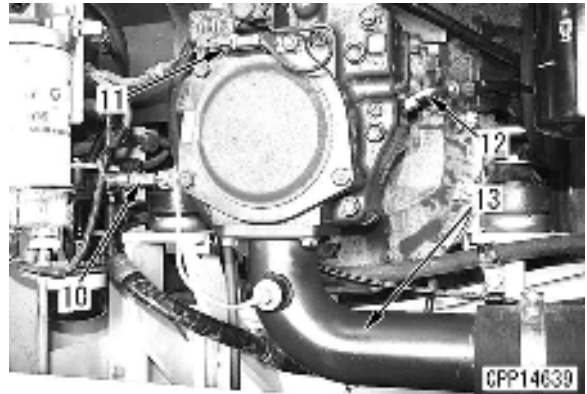


- 4) Remove plates (7) and (8).
- 5) Remove partition (9).



6. Removal of wiring and hoses around hydraulic pump

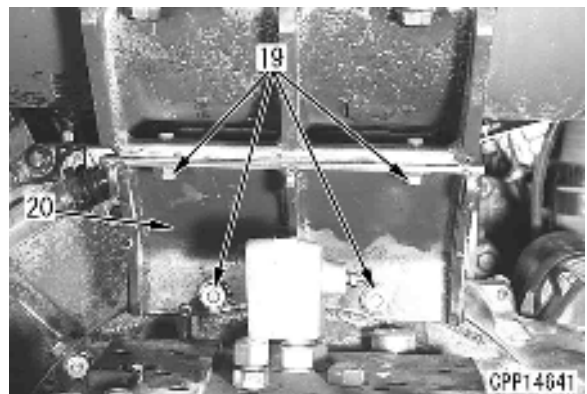
- 1) Disconnect wiring connectors P22 (10) and V11 (11).
- 2) Disconnect hose (12).
- 3) Disconnect suction tube (13) from the hydraulic pump assembly.



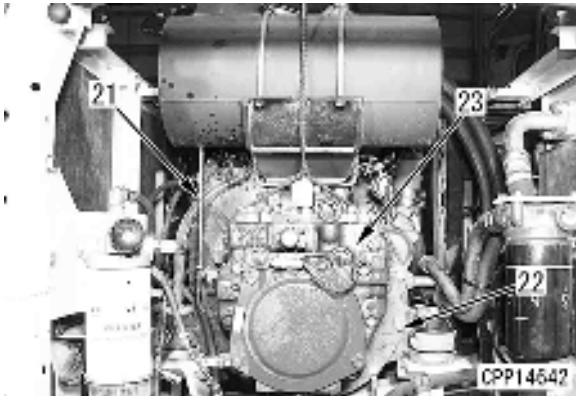
- 4) Disconnect hoses (14), (15), (16), (17) and (18).
- ★ When disconnecting these hoses, place a receiving pan under the pump.



7. Remove 4 muffler support bracket mounting bolts (19) and muffler support bracket (20).




8. Remove muffler drain tube (21).
9. Sling hydraulic pump assembly (23) and remove mounting bolts (22) which are mounting the hydraulic pump assembly to the fly-wheel housing.
 - ★ Record the installed position of the ground wire installed with the right lower bolt.
10. Lift off hydraulic pump assembly. [*2]
 - ★ Take care not to touch and break the right and left filters.





Installation

- Carry out installation in the reverse order to removal.

[*1]


-  Hydraulic tank drain plug:
58.8 – 78.5 Nm {6.0 – 8.0 kgm}

[*2]

-  Hydraulic pump involute spline:
Molybdenum disulphide lubricant (LM-G)
-  Hydraulic pump case mating face:
Gasket sealant (LG-6)

- **Refilling with oil (Damper case)**

- ★ Add oil through the oil filler to the specified level.

 Damper case: **EO30-CD 0.85 ℓ**

- **Refilling with oil (Hydraulic tank)**

- ★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

 Hydraulic tank: **167 ℓ**

- **Bleeding air**

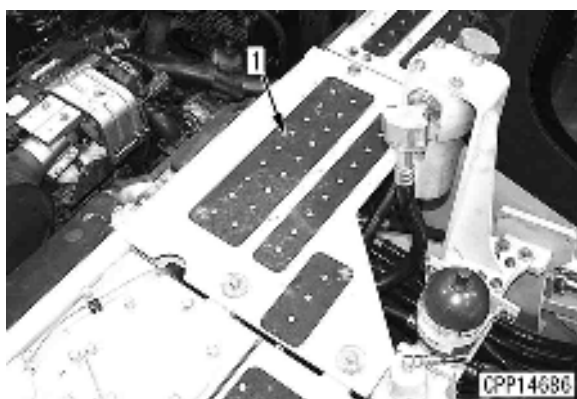
- ★ See Testing and adjusting, "Bleeding air from each part".

Removal and installation of control valve assembly

Removal

- ⚠ Lower the work equipment to the ground and stop the engine. Then, loosen the hydraulic oil filler cap slowly to release the internal pressure of the hydraulic tank.
- ⚠ Set the safety lock lever in the LOCK position.
- ★ Put tags to the disconnected hoses and tubes to prevent a mistake in re-connecting them.
- The 7-spool valve specification (6-spool valve + service valve) without an attachment is explained below.

1. Open the engine hood and remove cover (1).

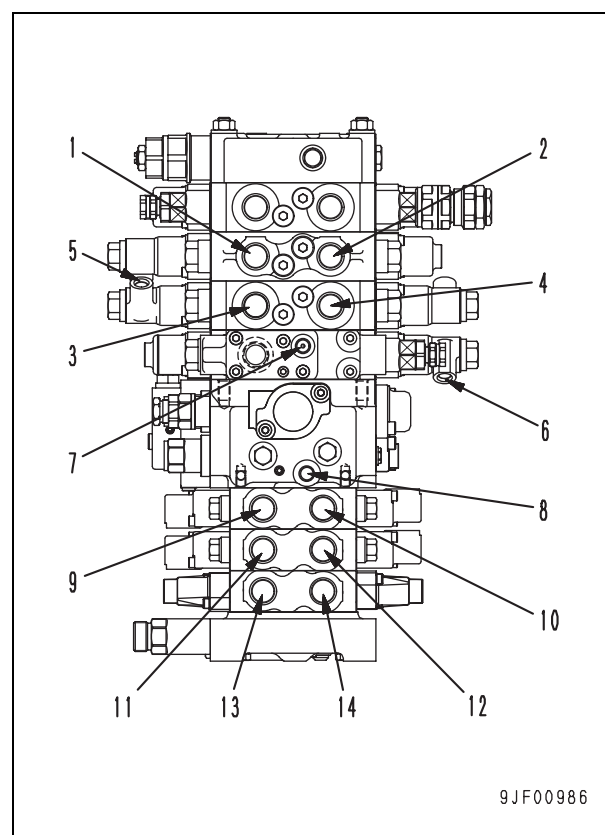


2. Remove covers (2) and (3).

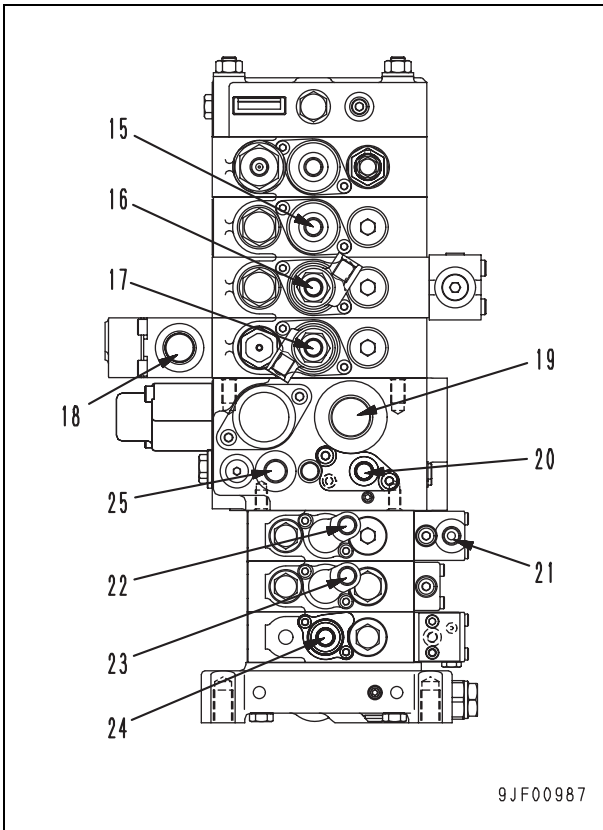


3. Disconnect the following hoses from the front of the control valve.

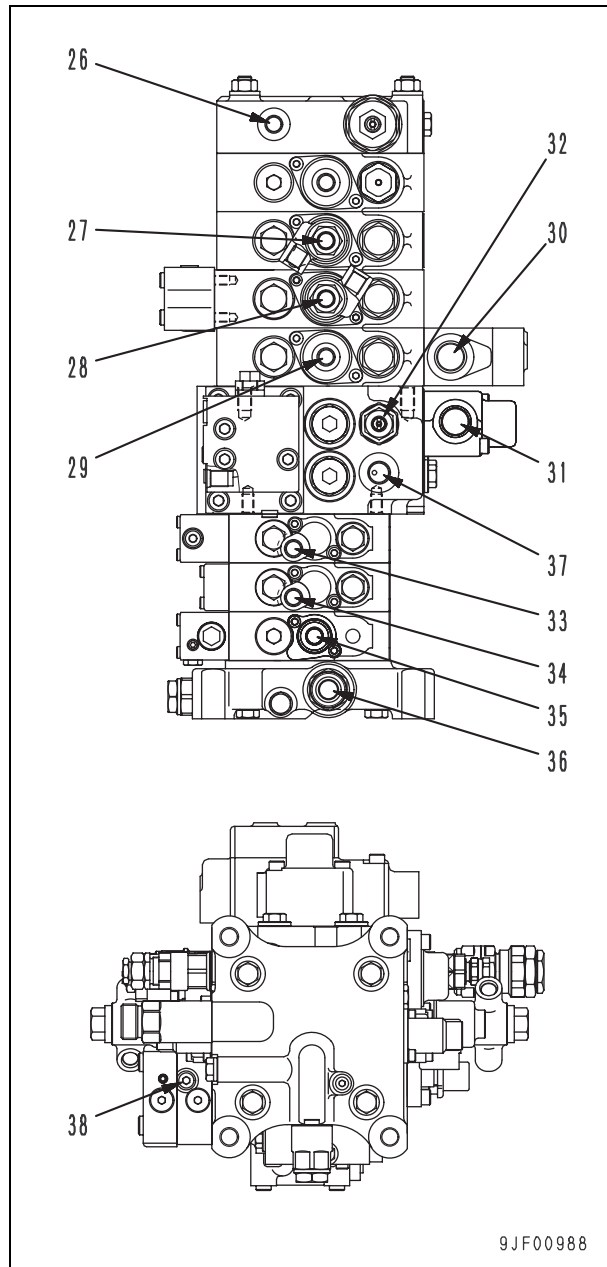
- (1) : Bucket cylinder (Head side)
- (2) : Bucket cylinder (Bottom side)
- (3) : Arm cylinder (Head side)
- (4) : Arm cylinder (Bottom side)
- (5) : Travel PPC valve
- (6) : Travel PPC valve
- (7) : Hydraulic tank
- (8) : Pump LS valve
- (9) : Left travel motor
- (10) : Left travel motor
- (11) : Right travel motor
- (12) : Right travel motor
- (13) : Swing motor
- (14) : Swing motor



4. Disconnect the following hoses and wiring connector from the left of the control valve.
 - (15): Bucket CURL PPC valve (Hose band: White)
 - (16): Arm IN PPC valve (Hose band: Blue)
 - (17): Boom LOWER PPC valve (Hose band: Blown)
 - (18): Boom cylinder (Head side)
 - (19): Oil cooler
 - (20): Pump merge-divider valve solenoid valve
 - (21): Travel junction valve solenoid valve
 - (22): Left travel REVERSE PPC valve
 - (23): Right travel REVERSE PPC valve (Hose band: Blue)
 - (24): Swing RIGHT PPC valve
 - (25): R pump pressure sensor connector P26

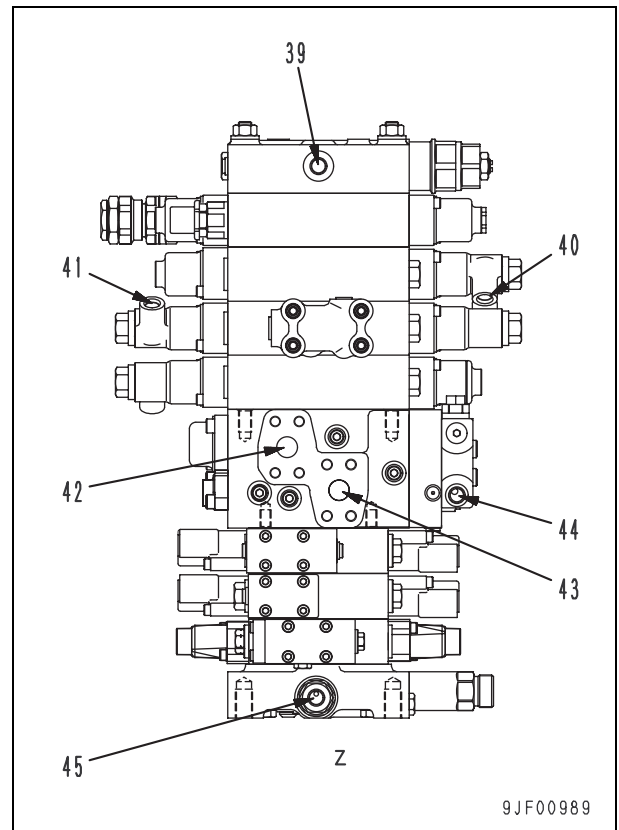


5. Disconnect the following hoses and wiring connector from the right of the control valve.
 - (26): Main pump
 - (27): Bucket DUMP PPC valve (Hose band: Black)
 - (28): Arm OUT PPC valve (Hose band: Yellow)
 - (29): Boom RAISE PPC valve (Hose band: Green)
 - (30): Boom cylinder (Bottom side)
 - (31): Hydraulic tank
 - (32): 2-stage relief solenoid valve
 - (33): Left travel FORWARD PPC valve (Hose band: Red)
 - (34): Right travel FORWARD PPC valve (Hose band: Green)
 - (35): Swing LEFT PPC valve (Hose band: Red)
 - (36): Swing motor
 - (37): F pump pressure sensor connector P25
 - (38): Oil pressure pickup hose (under pump merge-divider block)




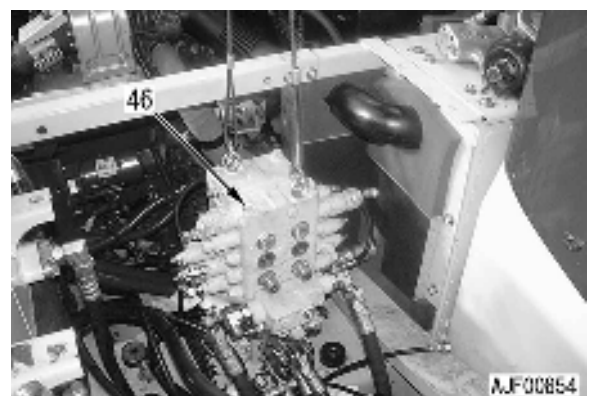
6. Disconnect the following hoses from the rear of the control valve.

- (39): Hydraulic tank
- (40): Travel PPC valve
- (41): Travel PPC valve
- (42): Main pump
- (43): Main pump
- (44): Oil pressure pickup hose
- (45): Boom RAISE PPC valve



7. Remove the 4 mounting bolts and lift off control valve assembly (46).

 Control valve assembly: **140 kg**



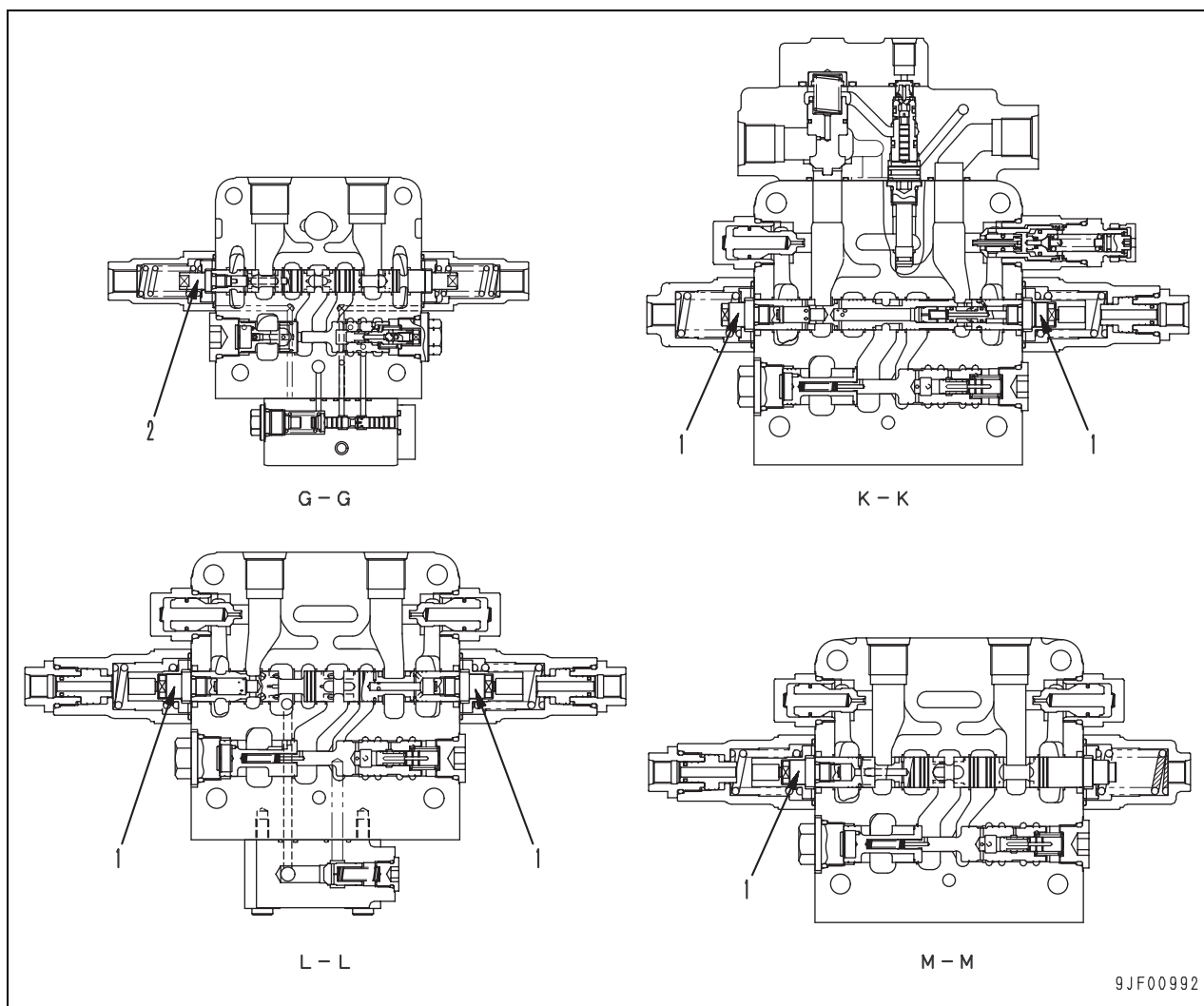
Installation

- Carry out installation in the reverse order to removal.
- **Refilling with oil (Hydraulic tank)**
 - ★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.
- **Bleeding air**
 - ★ Bleed air. For details, see Testing and adjusting, "Bleeding air from each part".

Disassembly and assembly of control valve assembly

- ★ Only precautions for assembling the control valve assembly are described below.
- ★ For the tightening torque of the control valve parts which are not shown in the following sectional view and explanation, see Structure and operation, maintenance standard, control valve.

Assembly

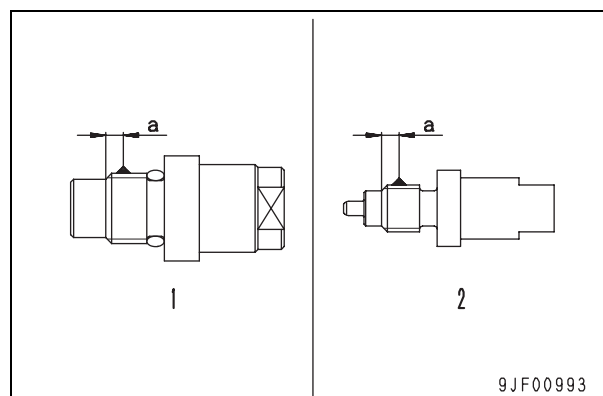


- ★ When tightening plugs (1) and (2) shown in the above figure, apply a drop (approx. 0.02 g) of LOCTITE (No. 638) to each of their parts "a" shown in the figure at right.

- Dimension (a) = 2 – 3 mm

Plugs (1) and (2):

14.7 – 19.6 Nm {1.5 – 2 kgm}



- ★ Tighten the 4 combination nuts on the top of the control valve in the following numerical order in 3 times.
- ★ The arrow in the figure indicates the front of the machine.

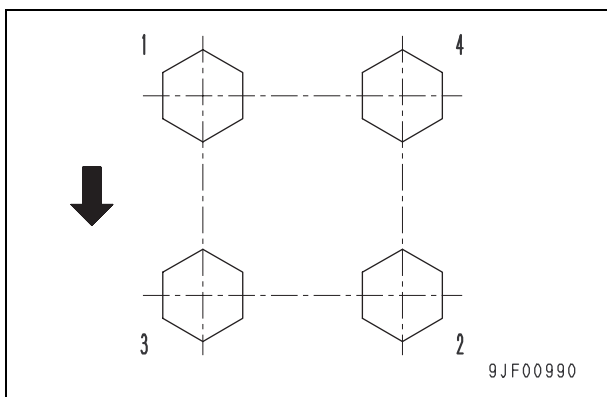
☞ Combination nut:

1st time : **58.8 – 68.8 Nm {6 – 7 kgm}**

2nd time : **78.5 – 88.3 Nm {8 – 9 kgm}**

3rd time :

98.1 – 113 Nm {10 – 11.5 kgm}



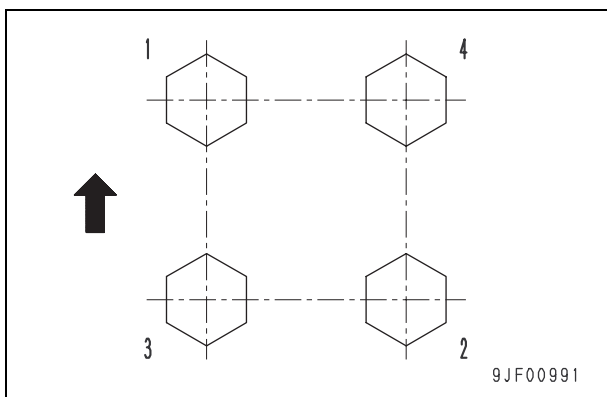
- ★ Tighten the 4 combination nuts on the under-side of the control valve in the following numerical order in 3 times.
- ★ The arrow in the figure indicates the front of the machine.

☞ Combination bolt:

1st time : **19.6 – 29.4 Nm {2 – 3 kgm}**

2nd time : **39.2 – 49.0 Nm {4 – 5 kgm}**

3rd time : **58.8 – 73.5 Nm {6 – 7.5 kgm}**



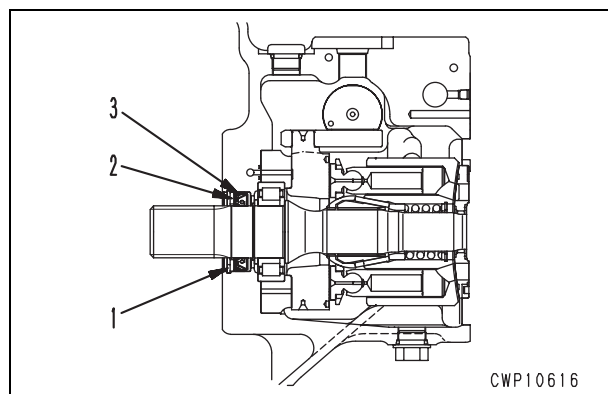
Removal and installation of hydraulic pump input shaft oil seal

Special tools

Symbol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
N	791-463-1350	Push tool	■	1		
	790-201-2740	Spacer	■	1		

Removal


1. Remove the hydraulic pump assembly. For details, see Removal and installation of hydraulic pump assembly.
2. Remove snap ring (1) and spacer (2).
3. Pry off oil seal (3) with a screwdriver, etc.[*1]
★ Take extreme care not to damage the shaft.



Installation

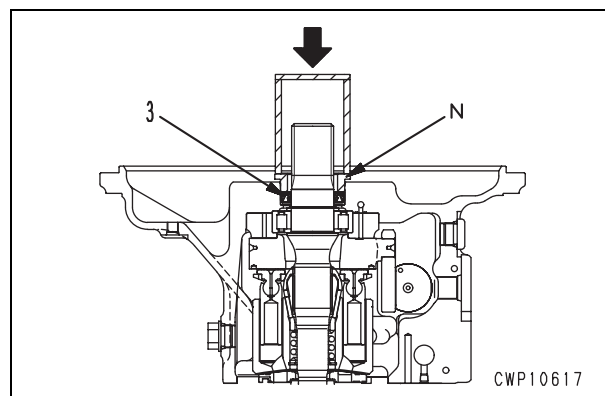
- Carry out installation in the reverse order to removal.

[*1]

- ★ Using tool N, press fit oil seal (3).
 Lip and periphery of oil seal:

Grease (G2-LI)

- ★ Apply grease thinly to the periphery of the oil seal.



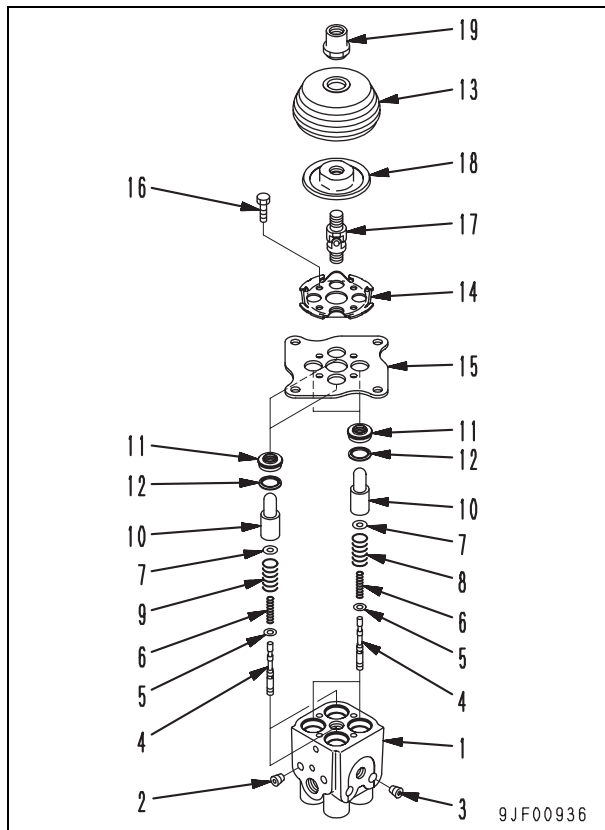
Disassembly and assembly of work equipment PPC valve assembly

Disassembly

- ★ Disassemble according to the following figure.

Assembly

- ★ Assemble according to the following figure.
- ★ Only precautions for assembly are explained below.



- ★ Install springs (6) with the small-diameter (inside diameter) end turns on the shims (5) side.
 - Diameters of spring end turn (Inside diameter)
 - Small diameter end turn: 4.9 mm
 - Large diameter end turn: 5.55 mm
- ★ Springs (8) and (9) are used for different hydraulic ports. When installing them, see the following table.
- ★ The position of each port is stamped on the underside of valve body (1).

Position of port	Spring	Part No.	Free length
P1, P2	(9)	702-16-53590	44.45 mm
P3, P4	(8)	702-16-53470	42.48 mm

- ★ When installing pistons (10), apply grease (G2-LI) to their outside and the inside of the valve body holes.

- ★ Tighten mounting bolts (16) of plates (14) and (15) (to be tightened together) to the following torque.

⌘ Mounting bolt:

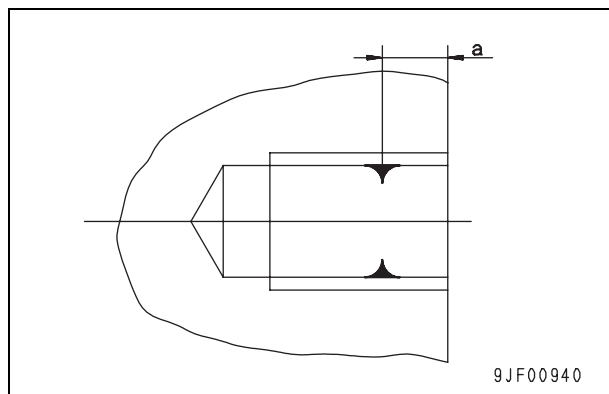
11.8 – 14.7 Nm {1.2 – 1.5 kgm}

- ★ Apply grease (G2 -LI) to the rocking parts of joint (17) and contact surfaces of disc (18) and pistons (10) by the following quantity.

- Rocking part of joint: 2 – 4 ml/all round
- Contact parts of disc and pistons: 0.3 – 0.8 ml/1 part

- ★ Install joint (17) to valve body (1) according to the following procedure.

- 1) Degrease and dry the threads of the joint and body thoroughly.
- 2) Apply 1 drop (approx. 0.02 g) of LOCTITE (No. 262) each to the 2 parts of dimension (a) from the end of the body screw hole.
 - Dimension (a) : **5 – 7 mm**



- 3) Tighten joint (17) to the following torque.

⌘ Joint: **39 – 49 Nm {4 – 5 kgm}**

- ★ Tighten nut (19) to the following torque.

⌘ Nut: **69 – 88 Nm {7 – 9 kgm}**

- ★ Adjust the play of the lever. For details, see Testing and adjusting, "Adjustment of work equipment and swing PPC valve".

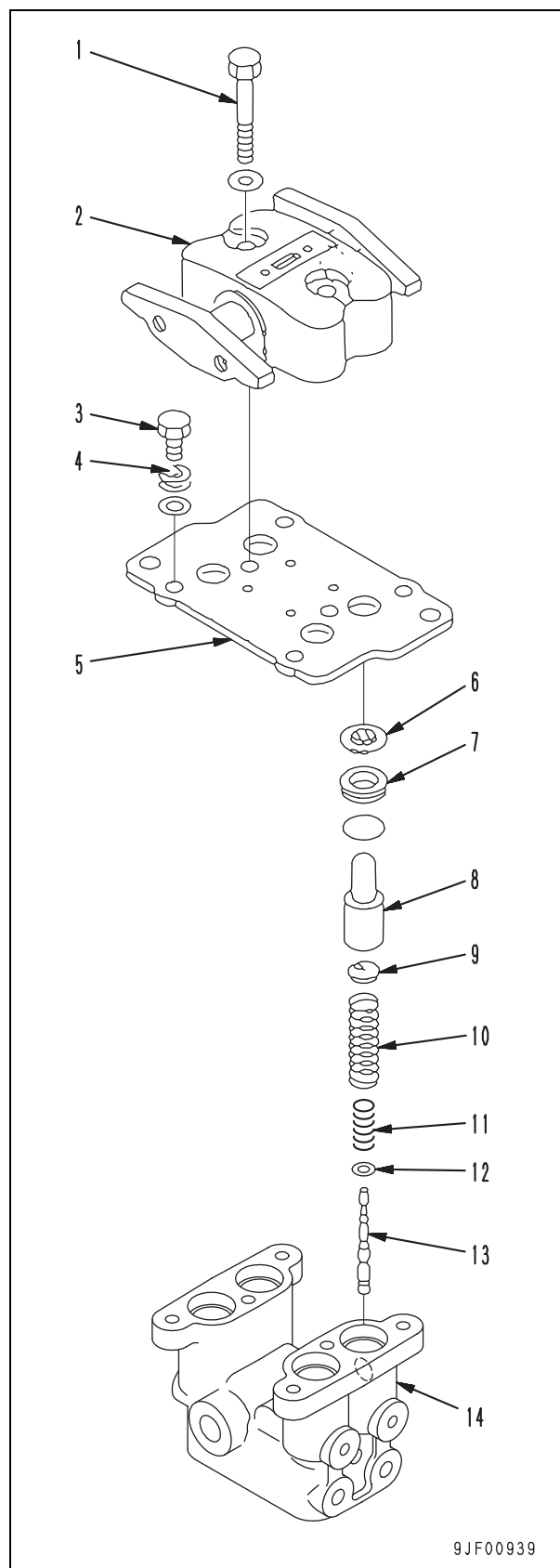
Disassembly and assembly of travel PPC valve assembly

Disassembly

- ★ Disassemble according to the figure at right.

Assembly

- ★ Assemble according to the figure at right.
- ★ Only precautions for assembly are explained below.
- ★ Install spring (11) with the small-diameter (inside diameter) end turn on the shim (12) side.
 - Diameters of spring end turn (Inside diameter)
 - Small diameter end turn: 4.9 mm
 - Large diameter end turn: 5.55 mm
- ★ When installing piston (8), apply grease (G2-LI) to its outside and the inside of the valve body hole.
- ★ Apply 0.3 – 0.8 ml of grease (G2-LI) to the contact surfaces of lever and piston (8).
- ★ Install washers (4) by the thickness and quantity checked when disassembled to the original position.
- ★ Tighten mounting bolts (3) to the following torque.
 - ⌘ Mounting bolt:
 - 27 – 34 Nm {2.8 – 3.5 kgm}**
- ★ Tighten mounting bolts (1) to the following torque.
 - ⌘ Mounting bolt:
 - 25 – 31 Nm {2.5 – 3.2 kgm}**



Disassembly and assembly of hydraulic cylinder assembly

Special tools

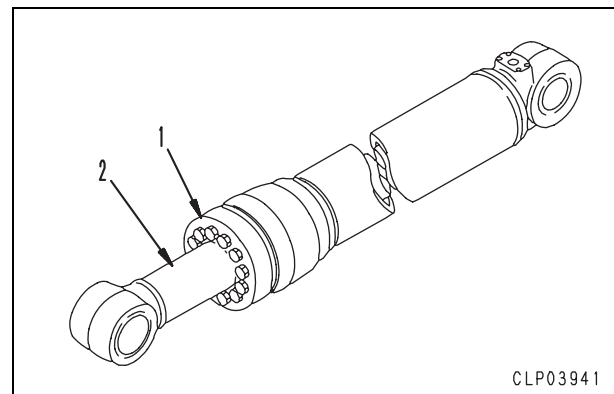
Sym- bol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
1	790-502-1003	Cylinder repair stand	■	1		
	790-102-4300	Wrench assembly	■	1		
2	790-102-4310	Pin	■	2		
	790-720-1000	Expander	●	1		
3	796-720-1660	Ring (for boom and bucket)	●	1		
	07281-01159	Clamp (for boom and bucket)	●	1		
	796-720-1670	Ring (for arm)	●	1		
	07281-01279	Clamp (for arm)	●	1		
	790-201-1702	Push tool KIT	■	1		
4	790-201-1821	• Push tool (for boom)		1		
	790-201-1940	• Push tool (for arm)		1		
	790-201-1811	• Push tool (for bucket)		1		
	790-101-5021	• Grip		1		
	01010-50816	• Bolt		1		
5	790-201-1500	Push tool KIT	●	1		
	790-201-5021	• Grip		1		
	01010-50816	• Bolt		1		
	790-201-1630	• Plate (for boom)		1		
	790-201-1620	• Plate (for bucket)		1		
	790-201-1980	Plate (for arm)	●	1		
	790-201-5021	Grip	●	1		
	01010-50816	Bolt	●	1		

Disassembly

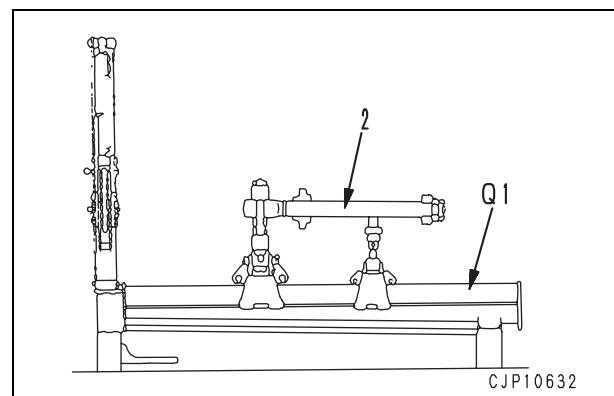
- ★ The following explanation is common to the boom, arm, and bucket cylinders, unless otherwise specified.

1. Piston rod assembly

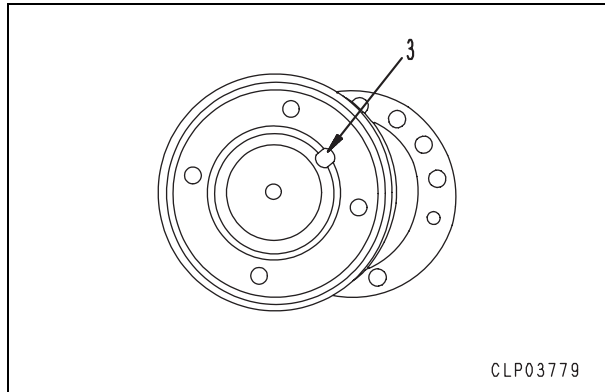
- 1) Remove the piping from the cylinder assembly.
- 2) Remove the mounting bolts and cylinder head assembly (1).
- 3) Pull out piston rod assembly (2).
 - ★ Put a container under the cylinder to receive oil.



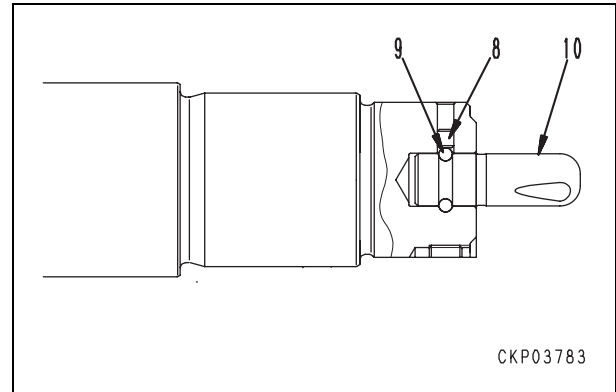
- 4) Set piston rod assembly (2) to tool Q1.



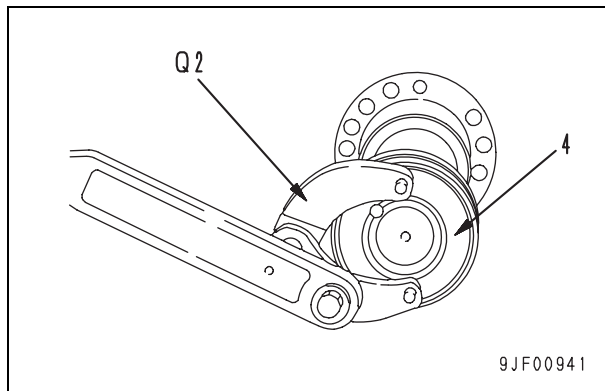
- 5) Remove piston assembly lock screw (3).
 ★ If the screw is so caulked that you cannot remove it, tighten it temporarily and cut the threads on it, and then remove it.



- 9) Remove cap (8), 11 balls (9), and plunger (10).
 ★ Take care not to lose the balls.
 ★ Perform this work for only the arm cylinder.

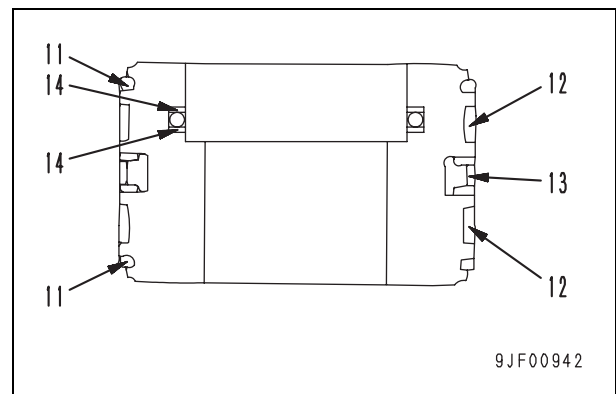


- 6) Using tool **Q2**, remove piston assembly (4).



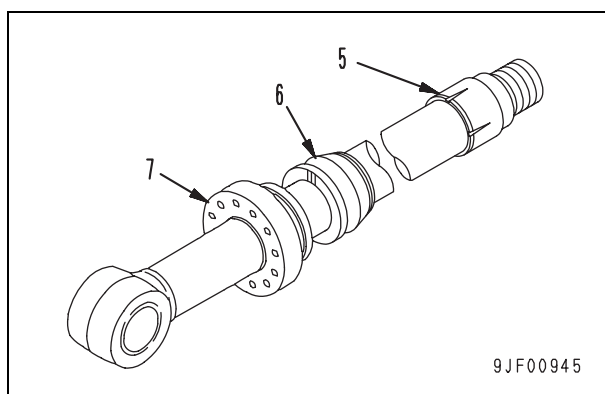
2. Disassembly of piston assembly

- 1) Remove rings (11), wear rings (12), and piston ring (13).
- 2) Remove the O-ring and backup rings (14).



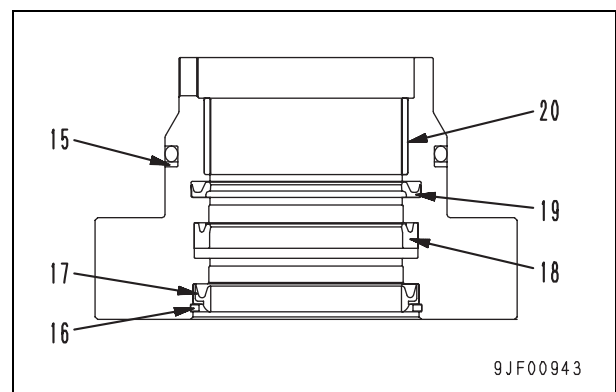
- 7) Remove plunger (5) and collar (6).
 ★ Perform this work for only the boom and arm cylinders.

- 8) Remove cylinder head assembly (7).



3. Disassembly of cylinder head assembly

- 1) Remove the O-ring and backup ring (15).
- 2) Remove snap ring (16) and dust seal (17).
- 3) Remove rod packing (18), buffer ring (19), and bushing (20).

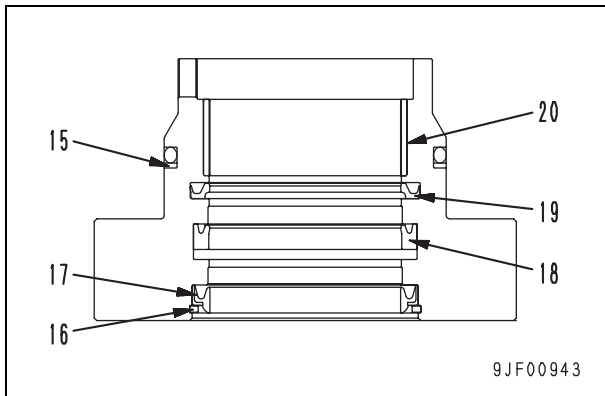
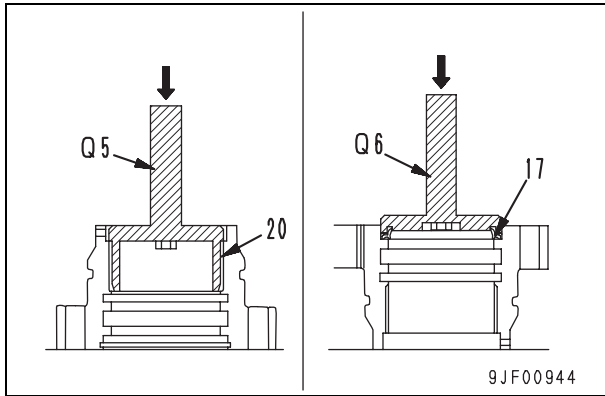


Assembly

- ★ The following explanation is common to the boom, arm, and bucket cylinders, unless otherwise specified.
- ★ Take care not to damage the packings, dust seals, O-rings, etc.
- ★ Clean the all parts. After installing them, cover the piping ports and pin holes to prevent dirt from entering.
- ★ Do not insert each backup ring forcibly, but warm it in water at 50 – 60 °C and then insert it.

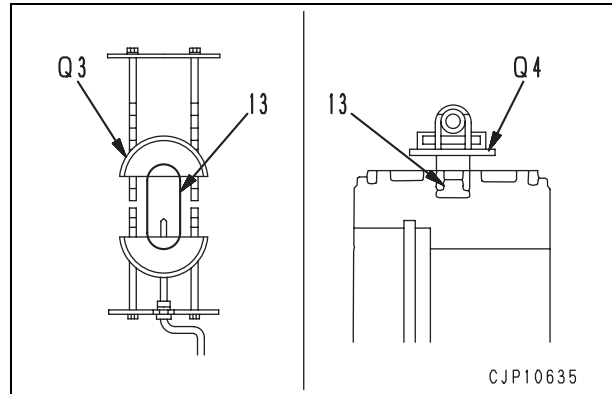
1. Assembly of cylinder head assembly


- 1) Using tool **Q5**, press fit bushing (20).
- 2) Install buffer ring (19) and rod packing (18).
- 3) Using tool **Q6**, install dust seal (17) and secure it with snap ring (16).
- 4) Install backup ring (15) and O-ring.

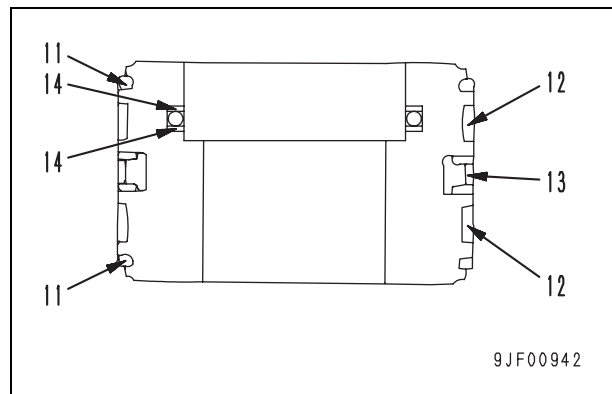


2. Assembly of piston assembly

- 1) Set piston ring (13) to tool **Q3** and turn the handle 8 – 10 times to expand the piston ring.
- 2) Using tool **Q4**, install piston ring (13).

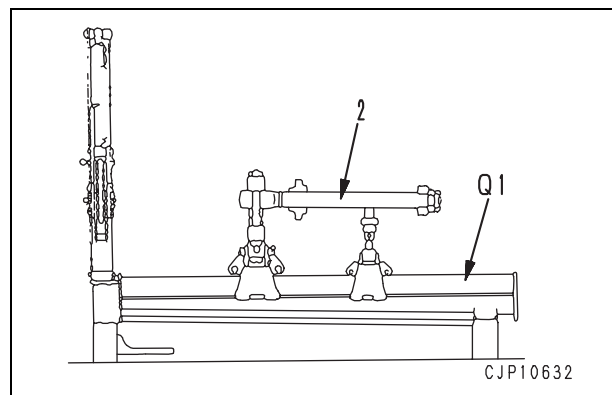


- 3) Install backup rings (14) and O-ring.
 - 4) Install wear rings (12).
 - 5) Install rings (11).
- ★ Do not increase the closed gap of the ring too much.
-  Ring groove: **Grease (G2-LI)**

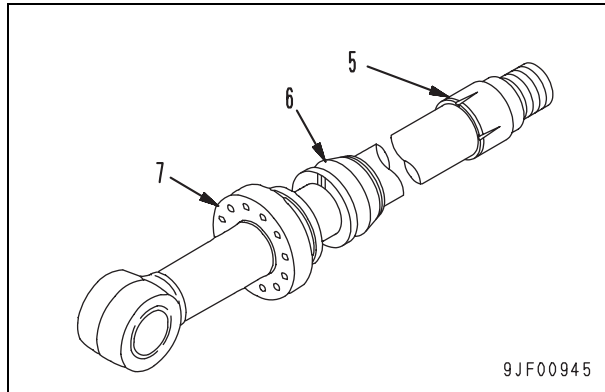


3. Piston rod assembly

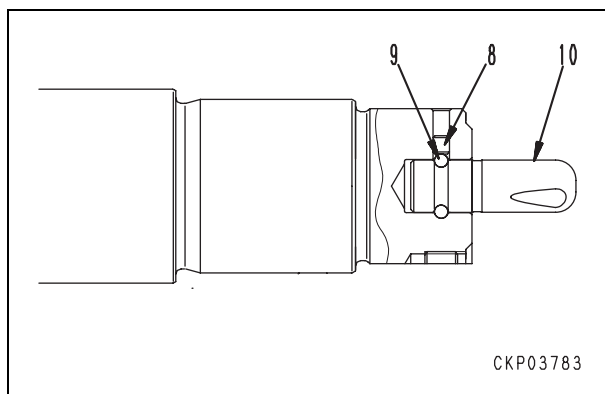
- 1) Set piston rod assembly (2) to tool **Q1**.



- 2) Install cylinder head assembly (7).
- 3) Fit the O-ring and backup ring to collar (6), and then install them.
 - ★ Perform this work for only the boom and arm cylinders.
- 4) Install plunger (5).
 - ★ Perform this work for only the boom and arm cylinders.

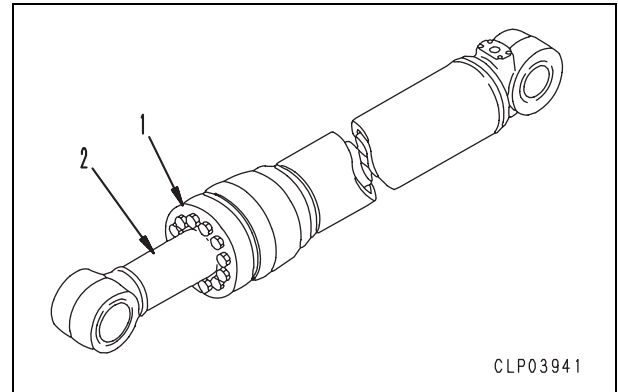


- 5) Set plunger (10) to the piston rod. Install 11 balls (9) and secure them with cap (8).
 - ★ After installing the plunger, check that it has a little play at its end.
 - ★ Perform this work for only the arm cylinder.

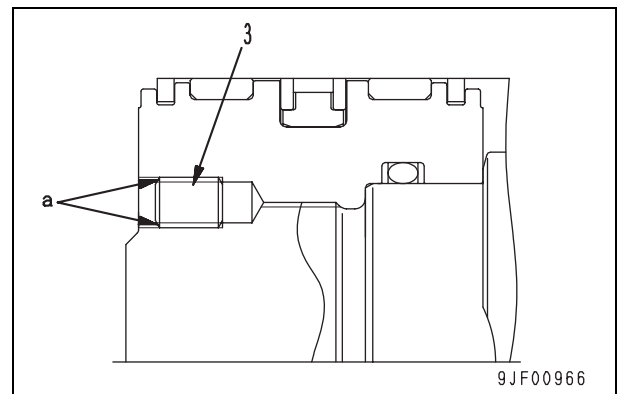



- When reusing the rod and piston assembly, assemble them according to the following procedure.
- ★ Clean the parts thoroughly and remove metal chips, dirt, etc.

- 6) Tighten piston assembly (4). Then, using tool Q2, tighten piston assembly (4) until the screw holes are aligned.
 - ★ Remove the burrs from the threads with a file.

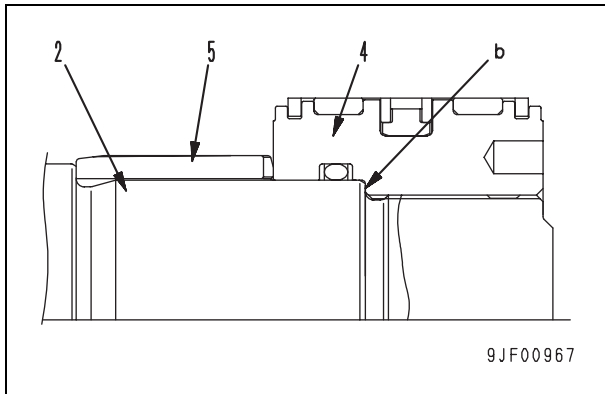


- 7) Tighten screw (3).
 - Threads of screw: **Adhesive (LOCTITE No. 262)**
 - Screw: **58.9 – 73.6 Nm {6 – 7.5 kgm}**
- 8) Caulk threaded part (a) by 4 places with a punch.



- When replacing either or both of the rod and piston assembly (2), assemble the new parts according to the following procedure.
- ★ Make a mark of the cushion plug position on the end of the rod having the bottom cushion. (Perform this work for only the arm cylinder.)
- 9) Using tool **Q2**, tighten piston assembly (4) until it reaches end (b) of the rod.
 -  Piston assembly:

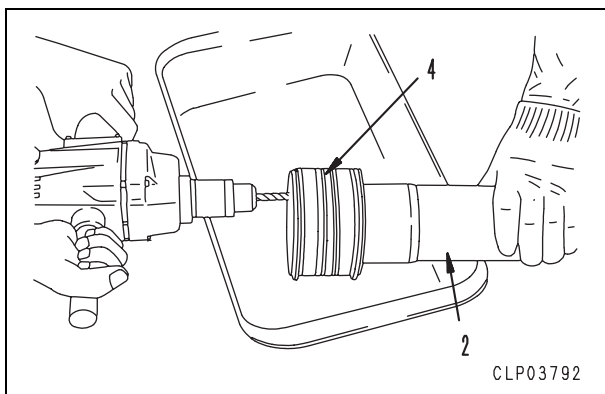
 $294 \pm 29.4 \text{ Nm}$ { $30 \pm 3.0 \text{ kgm}$ }
 - ★ After tightening the piston, check that plunger (5) has some play.
 - ★ Perform this work for only the boom and arm cylinders.




- 10) Make a screw hole to install screw (3).
- ★ Apply a drill to the V-groove of the threaded parts of piston (4) and rod (2) and make a hole.
 - ★ When making a hole on the cylinder having the bottom cushion, make it around the cushion plug. (Perform this work for only the arm cylinder.)
 - Dimensions of screw hole (mm)

Tap drill diameter	Tap drill hole depth	Tap to be used	Tapping depth
10.3	27	12 × 1.75	20


- 11) After making the hole, remove all metal chips and dirt.



- 12) Tighten screw (3).

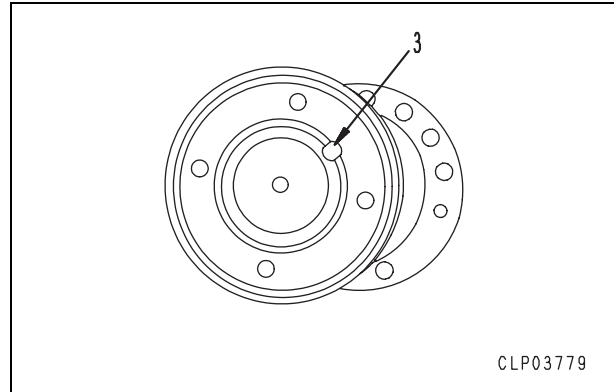
 Threads of screw:

Adhesive (LOCTITE No. 262)

 Screw:

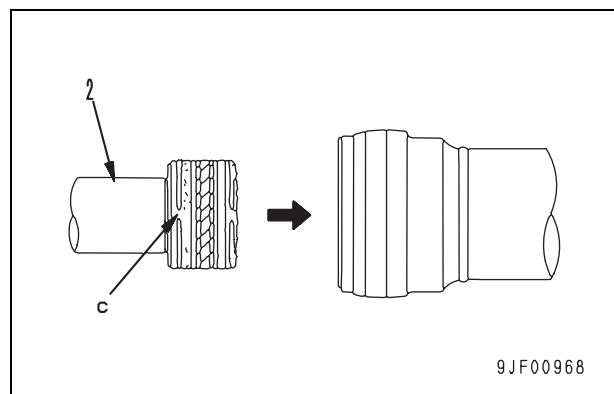
$58.9 - 73.6 \text{ Nm}$ { $6 - 7.5 \text{ kgm}$ }

- 13) Caulk the threaded part by 4 places with a punch.



- 14) Install piston rod assembly (2).

- ★ Set the abutment joint of the ring at a side and insert the piston rod, aligning it with the cylinder tube.
- ★ After inserting the piston rod, check that the ring is not broken or removed, and then insert to the end.



- 15) Tighten the mounting bolts of cylinder head assembly (1).

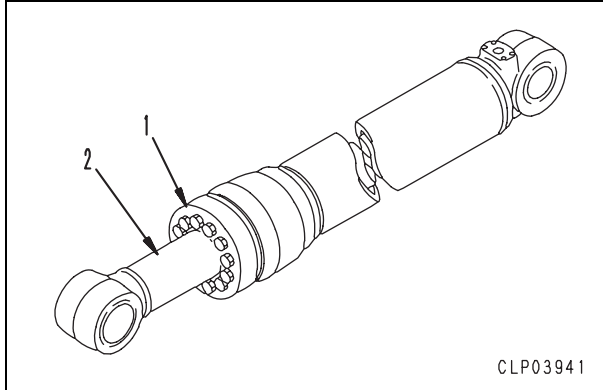
🔧 Mounting bolt:

Boom/Bucket cylinder:

$270 \pm 39.0 \text{ Nm}$ { $27.5 \pm 4.0 \text{ kgm}$ }

Bucket cylinder:

$172 \pm 24.5 \text{ Nm}$ { $17.5 \pm 2.5 \text{ kgm}$ }



- 16) Install the piping.

- ★ Tighten the bolts to install the piping band to the cylinder to the following torque.

🔧 **$27.4 \pm 6.9 \text{ Nm}$ { $2.8 \pm 0.7 \text{ kgm}$ }**

Disassembly and Assembly of Quick Coupler Valve

REMOVAL OF PRESSURE REGULATING VALVE

1. The pressure regulating valve (1) can be removed as a complete unit using 26mm spanner.
- In case of malfunction of regulating valve replace the unit.

REMOVAL OF SOLENOID AND DIRECTIONAL CONTROL VALVE

1. Remove nut 2a using 3/4" spanner.
2. Remove directional control valve (3) using 7/8" spanner.
- In case of malfunction of the coil or the directional control valve replace them as complete units.

INSTALLATION

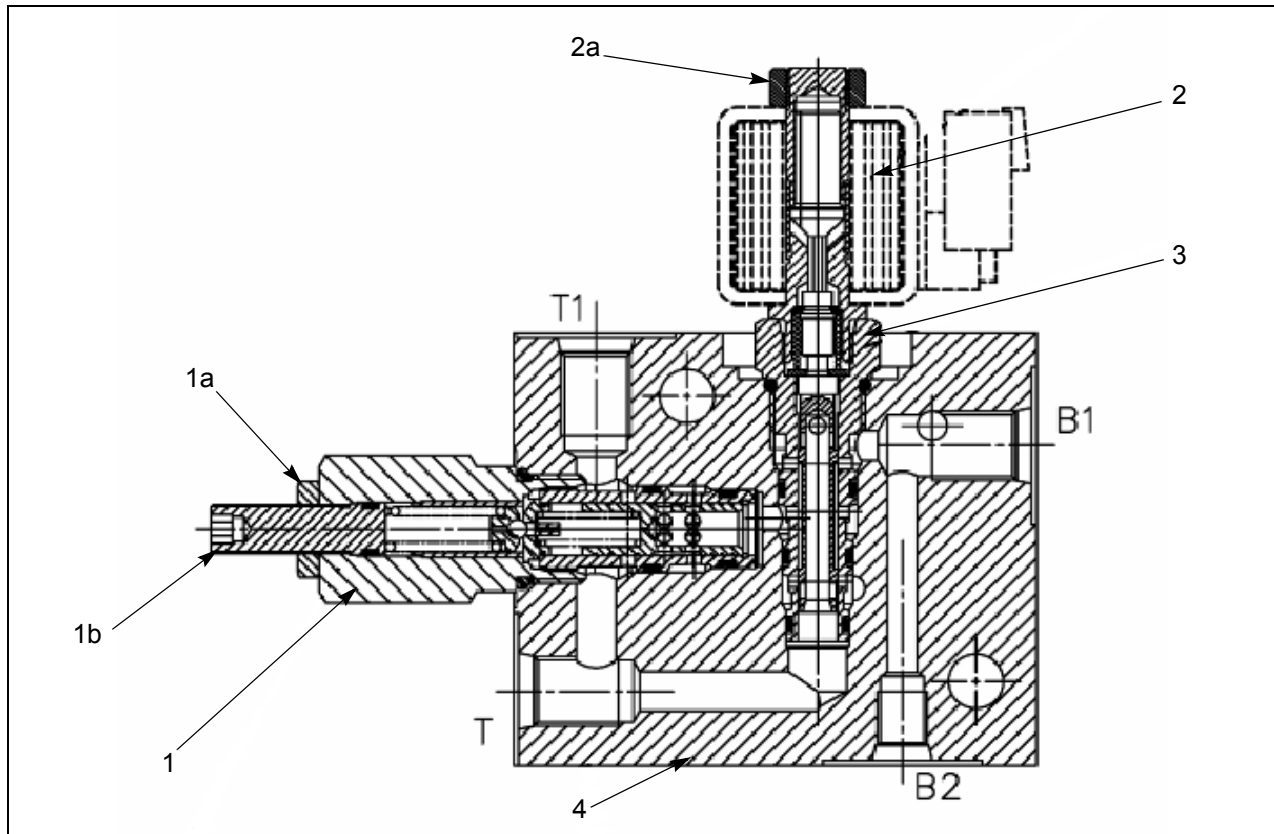
- Install in reverse order to removal.

Tightening torque values for:

Directional control valve (3/4" - 16UNF) - 24 - 36Nm

Solenoid (3/4" hex) - 3.3 - 4.9Nm

Pressure regulating valve (7/8" - 14 UNF, 26A/F) - 40 - 60Nm



- | | |
|----|---------------------------|
| 1 | Pressure regulating valve |
| 1a | Lock nut |
| 1b | Adjustment screw |
| 2 | Solenoid |
| 2a | Nut |
| 3 | Directional control valve |
| 4 | Block |

PC160LC-7E0, PC180LC/NLC-7E0 Hydraulic Excavator

Form No. UEN02451-01

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HYDRAULIC EXCAVATOR

PC160LC-7E0

PC180LC-7E0

PC180NLC-7E0

Machine model	Serial number
---------------	---------------

PC160LC-7E0	K45001 and up
PC180LC-7E0	K45001 and up
PC180NLC-7E0	K45001 and up

50 Disassembly and assembly

Work equipment Body

Removal and installation of work equipment assembly 2

Removal and installation of work equipment assembly

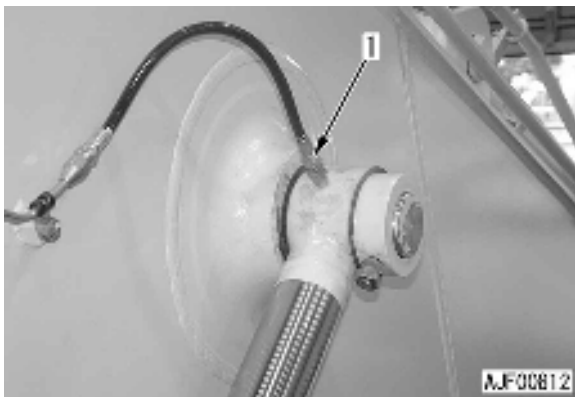
Special tools

Sym-bol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
R	796-900-1200	Remover	■	1		
	790-101-4000	Puller (490 kN {50 t}, long)	■	1		
	790-101-1102	Pump (294 kN {30})	■	1		

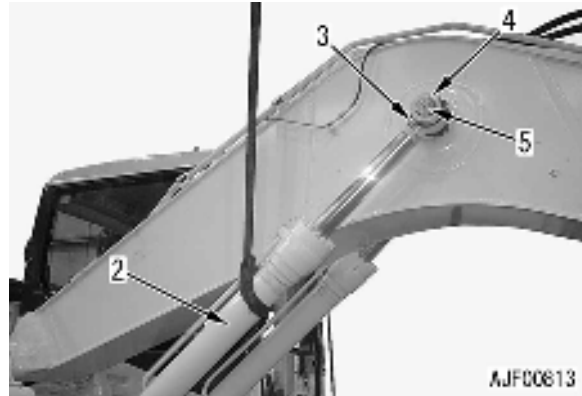
Removal

- ⚠ Except the arm and bucket fully. Lower the work equipment to the ground and set the safety lock lever to the lock position.
- ⚠ Release the residual pressure in the hydraulic circuit. For details, see Testing and adjusting, "Release of residual pressure from hydraulic circuit".

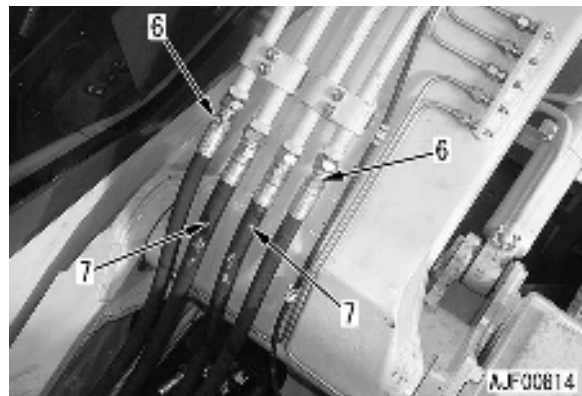
1. Disconnect grease hose (1).



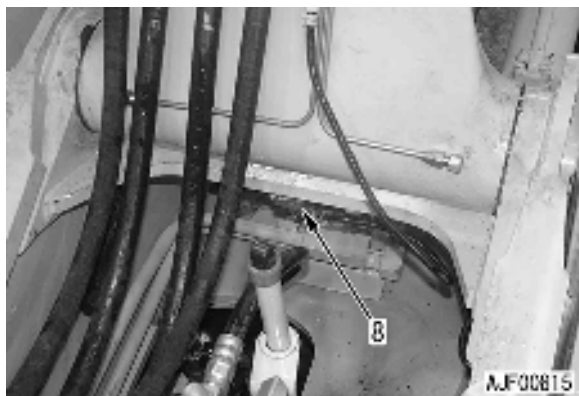
2. Sling boom cylinder assembly (2), and remove lock bolt (3).
3. Remove plate (4), then remove head pin (5). [*1]
★ There are shims installed, so check the number and thickness, and keep them in a safe place.



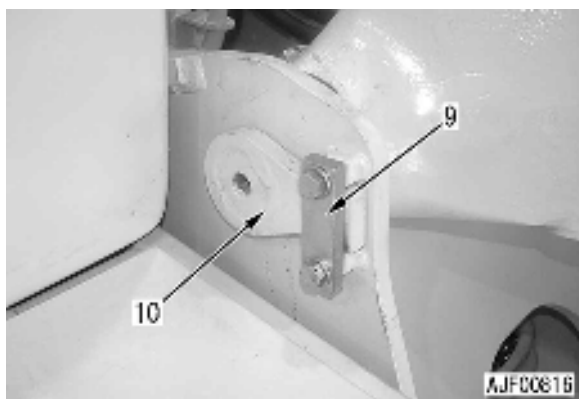
4. Start the engine and retract the piston rod.
★ Fasten the piston rod with wire so that it will not slip out and lower the cylinder onto a stand, or place a support under the bottom of the cylinder to support it. In the latter case, remove the grease fitting on the bottom side first.
★ Remove the bottom cylinder on the other side in the same manner.
5. Disconnect 2 bucket cylinder hoses (6) and 2 arm cylinder hoses (7), two for each.
★ Put tags to the disconnected hoses and tubes to prevent a mistake in re-connecting them.
★ Put an oil stopper plug to each hose connecting part and bind the hose with ropes, etc. so that it will not be an obstacle to the work.



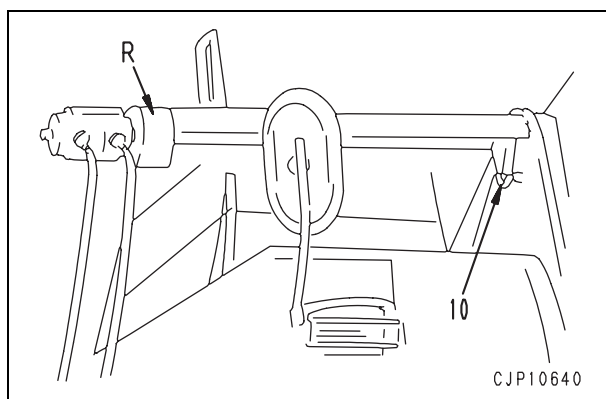
6. Disconnect connector A42 (8).



7. Lift off work equipment and remove plate (9) and then pin (10) at the foot. [*2]



- When removing them, first remove plate (9) and then remove pin (10) at the foot, using tool **R**.
- ★ Shims are installed, so do not forget to check their number and each location of installation.



8. Lift work equipment assembly (11) and disassemble it.



Work equipment assembly: **2,700 kg**

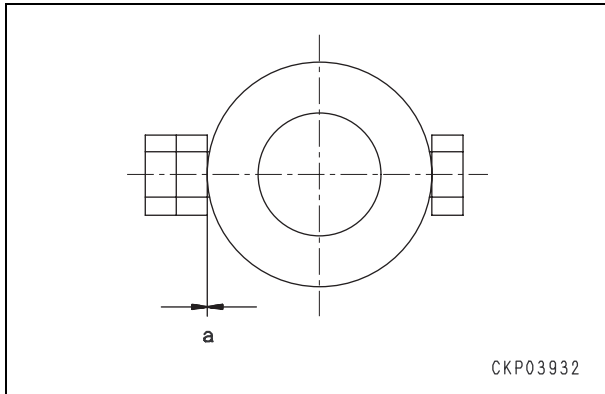



Installation

- Install in reverse order of removal.

[*1]

- ★ When tightening the locknut, tighten so that clearance a between the plate and nut is 0.5 – 1.5 mm.



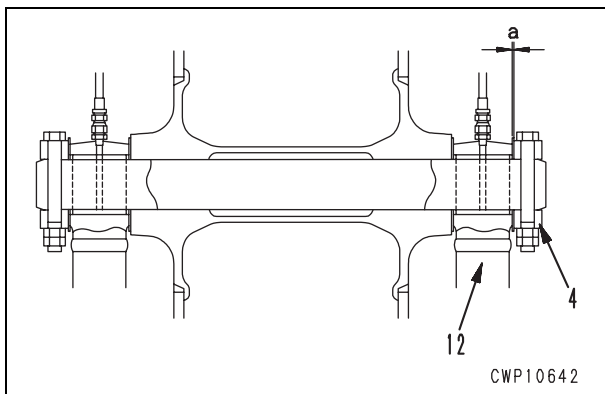
 Inside surface of bushing when assembling pin: **Anti-friction compound (LM-P)**

 Grease after assembling pin:


Grease (LM-G)

⚠ When aligning the position of the pin hole, never insert your fingers into the pin hole.

- ★ Adjust the shim thickness so that clearance a between cylinder rod (12) and plate (4) is below 1.5 mm.
 - ★ Standard shim thickness: 1.0 mm and 2.0 mm.



[*2]

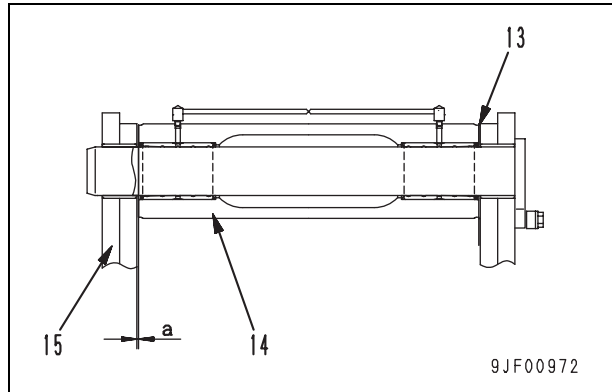
 Inside surface of bushing when assembling pin: **Anti-friction compound (LM-P)**

 Grease after assembling pin:

Grease (LM-G)

⚠ When aligning the position of the pin hole, never insert your fingers into the pin hole.

- ★ Adjust clearance a between boom (14) and frame (15) with shim (13) (Thickness: 2.0 mm) so that it will be less than 1 mm.
 - Thickness of standard shims: 2.0, 2.5, 3.0 and 3.5 mm.



- **Refilling with oil (hydraulic tank)**

- ★ Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.

- **Bleeding air**

- ★ Bleed air. For details, see Testing and adjusting, "Bleeding air from each part".

PC160LC-7E0, PC180LC/NLC-7E0 Hydraulic Excavator

Form No. UEN02452-00

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HYDRAULIC EXCAVATOR

PC160LC-7E0
PC180LC-7E0
PC180NLC-7E0

Machine model	Serial number
PC160LC-7E0	K45001 and up
PC180LC-7E0	K45001 and up
PC180NLC-7E0	K45001 and up

50 Disassembly and assembly

Cab and its attachments

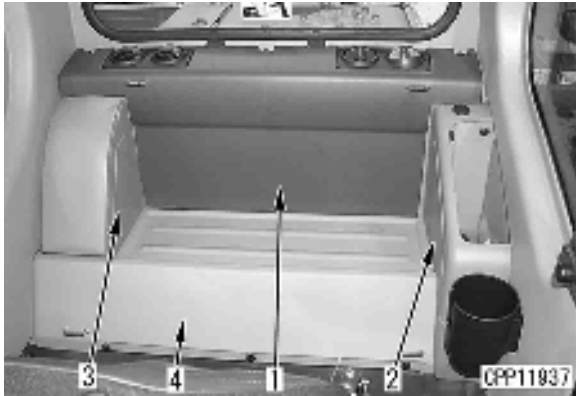
Removal and installation of operator's cab	2
Removal and installation of operator's cab glass (Stuck glass)	5
Removal and installation of front window assembly	16
Removal and installation of floor frame assembly	22

Removal and installation of operator's cab

Removal

⚠ Disconnect the cable from the negative (–) terminal of the battery.

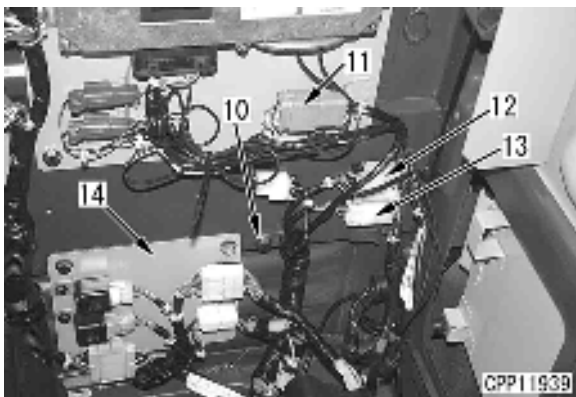
1. Remove rear covers (1), (2), (3), and (4).



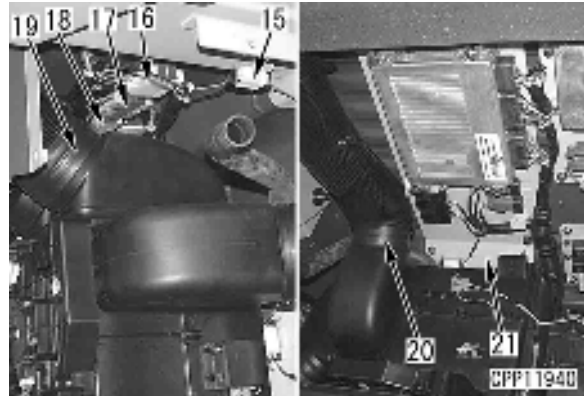
2. Remove duct (5), cover (6), and plate (7).
3. Remove plate (8), duct (9) and the element.
★ Remove the duct lock clip.



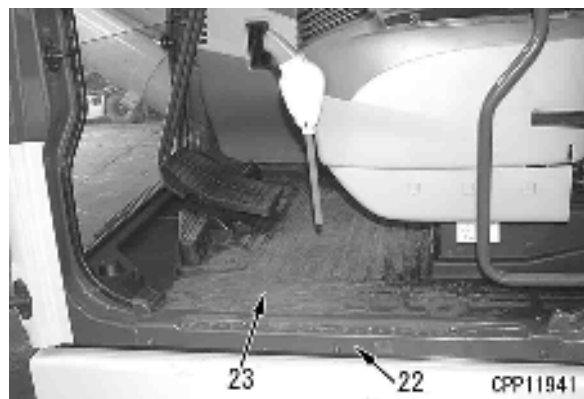
4. Remove clip (10) and disconnect cab wiring connectors M45 (11), H08 (12), and H09 (13).
5. Remove air conditioner connector plate (14).



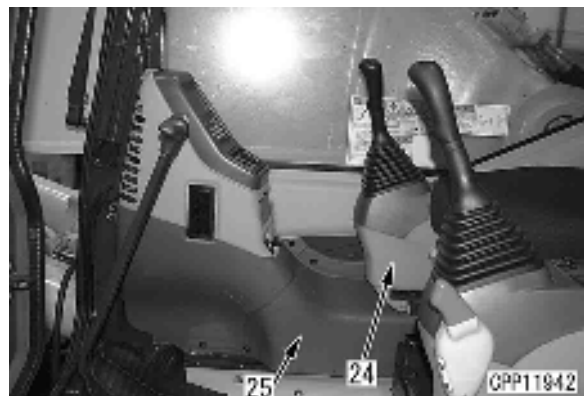
6. Disconnect connectors M71 (15), H10 (16), H11 (17), and H12 (18).
7. Disconnect upper and lower duct joints (19) and (20).
8. Remove controller sub-plate (21) and incline it against the air conditioner.



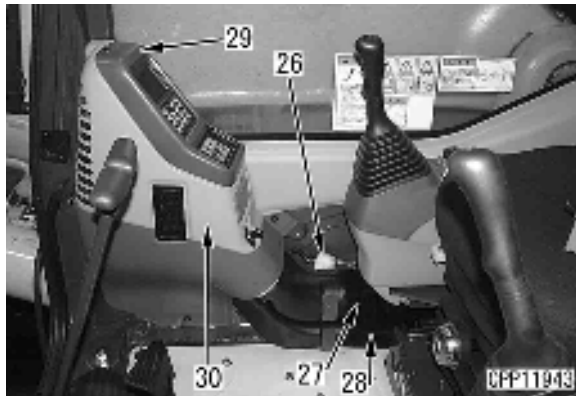
9. Remove cover (22) and floor mat (23).



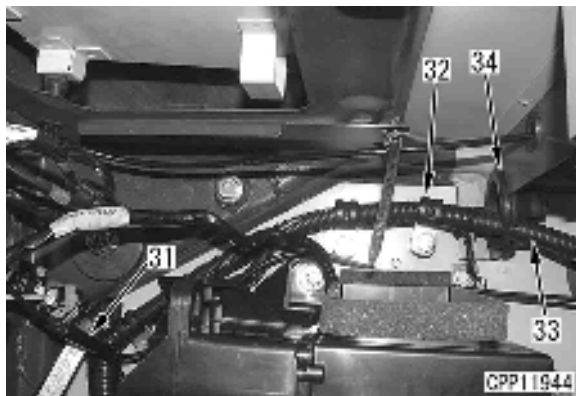
10. Move right console (24) into the cab.
11. Remove monitor panel undercover (25).



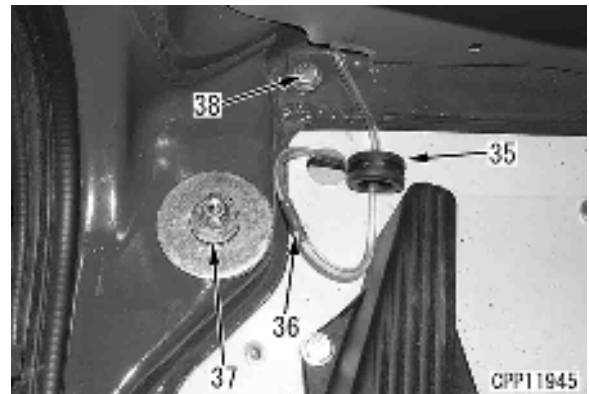
12. Disconnect cab wiring connector W04 (26) (Wiper motor).
13. Remove ducts (27) and (28).
 - ★ Both (27) and (28) are 2 in number.
 - ★ Cut the tie-wrap on the monitor wiring harness.
14. Remove cover (29) and monitor assembly (30).




15. Disconnect radio antenna (31).
16. Remove clip (32) and take wiring harness (33) out of grommet (34).



17. Take grommet (35) out of the right front of the cab.
18. Disconnect the windshield washer hose from (36).
19. Remove 4 mounting bolts (37) and 5 mounting bolts (38).
 - ★ Check the types of the bolts.
 - ★ In the initial period, 7 mounting bolts (38) are used.



20. Using lever block [1], lift off operator's cab assembly (39).

 Operator's cab assembly: **300 kg**



21. When starting the engine while the operator's cab is removed (for transportation, etc.), use the following brackets.

- 1) Bracket (41) for controller (40)
Part No.: 208-53-13920



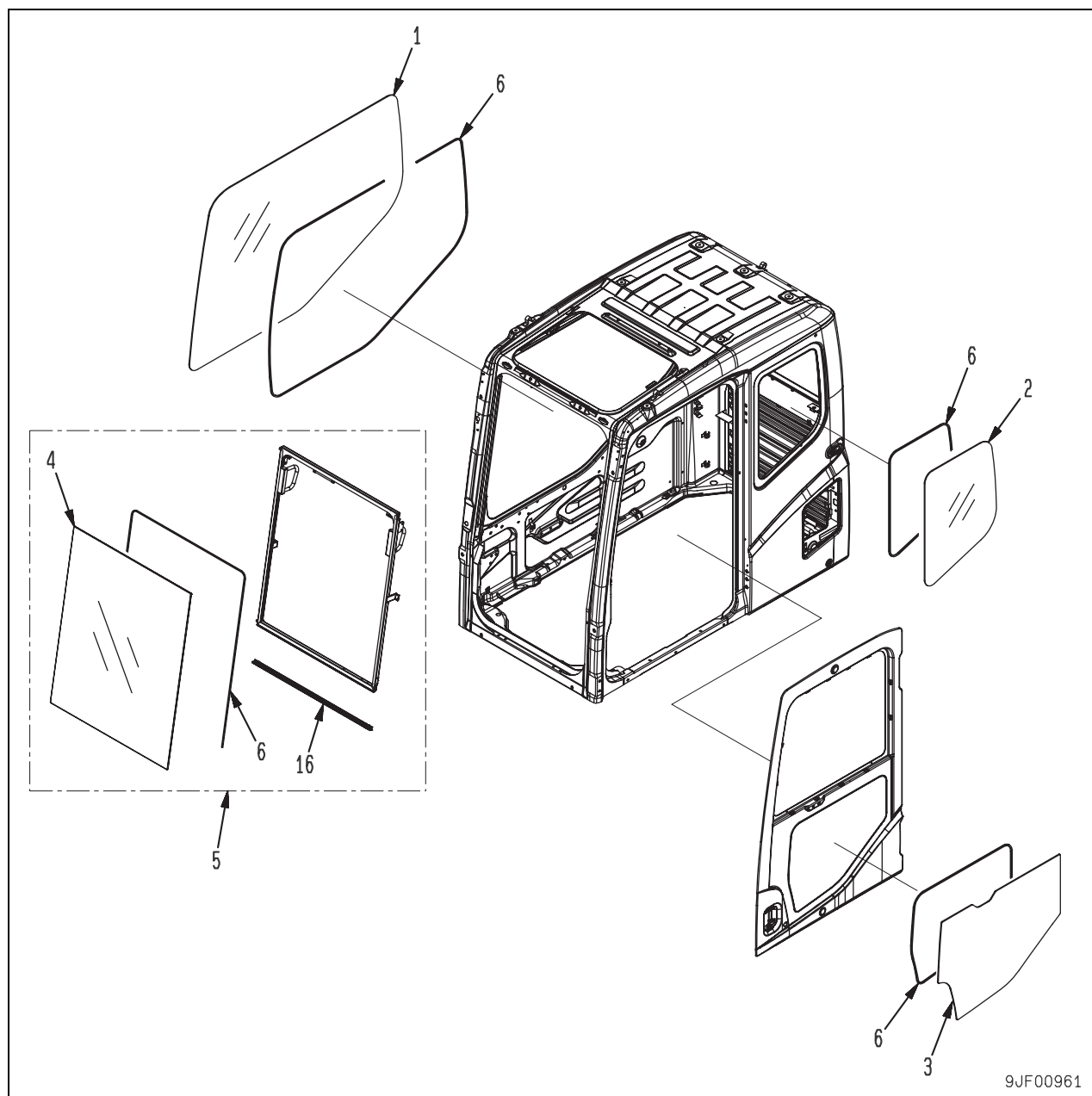
- 2) Bracket (42) for monitor panel assembly (30)
Part No.: 208-53-13910



Installation

- Carry out installation in the reverse order to removal.

Removal and installation of operator's cab glass (Stuck glass)



9JF00961

* Among the panes of window glass on the 4 sides of the operator's cab, 4 panes (1) – (4) are stuck.

In this section, the procedure for replacing the stuck glass is explained.

When replacing front window glass (4), remove front window assembly (5). (It is impossible to replace only the front window glass while the front window assembly is installed to the operator's cab.)

For the procedure for replacing the front window assembly, see Removal and installation of front window assembly.

- (1) : Right side window glass
- (2) : Left side rear window glass
- (3) : Door lower window glass
- (4) : Front window glass
- (5) : Front window assembly
(Front window glass + Front frame)
- (6) : Double-sided adhesive tape
- (16) : Centre trim seal

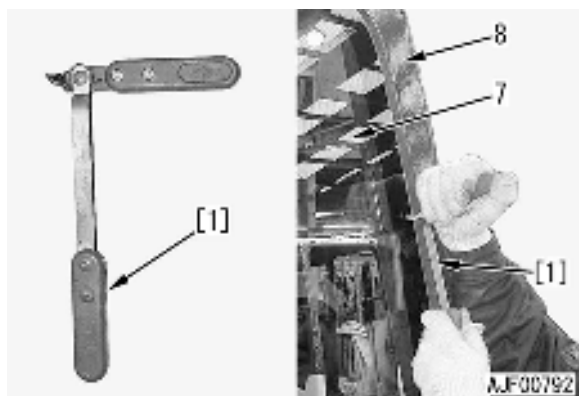
Special tools

Symbol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
X	1 793-498-1210	Lifter (Suction cup)	■	2		
	2 20Y-54-13180	Seat	■	2		

Removal

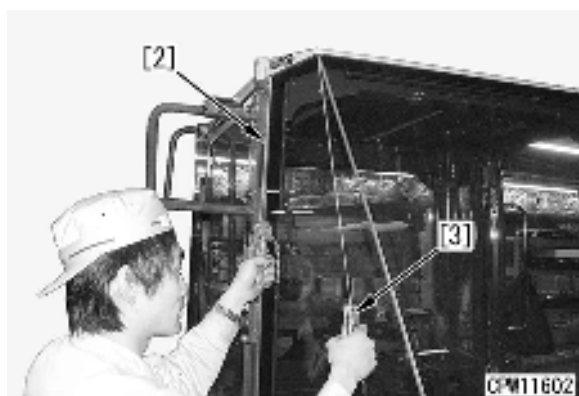
* Remove the window glass to be replaced according to the following procedure.

1. Using seal cutter [1], cut the adhesive between broken window glass (7) and operator's cab (metal sheet) (8).



- ★ If a seal cutter is not available, make holes on the adhesive and double-sided adhesive tape with a drill and pass a fine wire (piano wire, etc.) [2] through the holes. Grip the both ends of the wire with pliers [3], etc. (or hold them by winding them onto something) and move the wire to the right and left to cut the adhesive and double-sided adhesive tape. Since the wire may be broken by the frictional heat, apply lubricant to it.

(The figure shows the operator's cab of a wheel loader.)



- ★ If the window glass is broken finely, it may be removed with knife [4] and a screwdriver.
- ★ Widening the cut with a screwdriver, cut the adhesive and double-sided adhesive tape with knife [4].

(The figure shows the operator's cab of a wheel loader.)

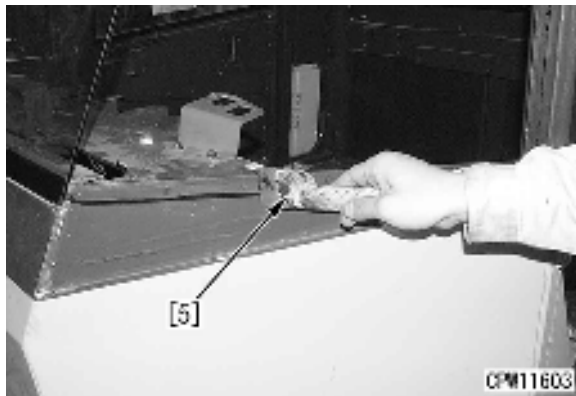


2. Remove the window glass.

Installation

1. Using a knife and scraper [5], remove the remaining adhesive and double-sided adhesive tape from the metal sheets (glass sticking surfaces) of the operator's cab.
 - ★ Remove the adhesive and double-sided adhesive tape to a degree that they will not affect adhesion of the new adhesive. Take care not to scratch the painted surfaces. (If the painted surfaces are scratched, adhesion will be lowered.)

(The figure shows the operator's cab of a wheel loader.)

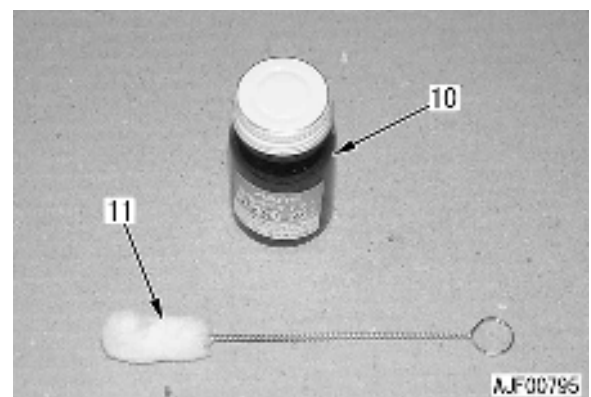


2. Remove oil, dust, dirt, etc. from the sticking surfaces of cab (8) and window glass (9) with white gasoline.
 - ★ If the sticking surfaces are not cleaned well, the glass may not be stuck perfectly.
 - ★ Clean the all black part on the back side of the window glass.
 - ★ After cleaning the sticking surfaces, leave them for at least 5 minutes to dry.

(The figure shows the operator's cab of a wheel loader.)



3. Apply primer (10).
 - ★ The using limit of primer (10) is 4 months after the date of manufacture. Do not use primer (10) after this limit.
 - ★ Use the primer within 2 hours after unpacking it.
 - ★ Even if the primer is packed again just after it is unpacked, use it within 24 hours after it is unpacked for the first time. (Discard the primer 24 hours after it is packed.)
- 1) Stir the primers for paint and glass sufficiently before using them.
 - ★ If the primer has been stored in a refrigerator, leave it at the room temperature for at least half a day before stirring it. (If the primer is unpacked just after taken out of the refrigerator, water will be condensed. Accordingly, leave the primer at the room temperature for a sufficient time.)
- 2) When reusing primer brush (11), wash it in white gasoline.
 - ★ After washing the brush, check it again for dirt and foreign matter.
 - ★ Prepare respective brushes for the paint primer glass primer.

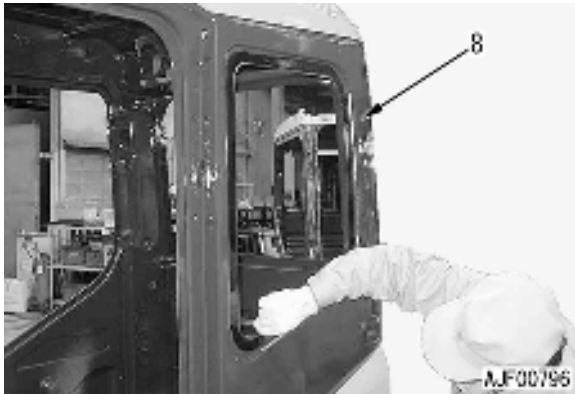


- 3) Evenly apply paint primer to the surfaces to stick double-sided adhesive tapes and the surfaces out of those surfaces on operator's cab (8) which will be coated with the adhesive.

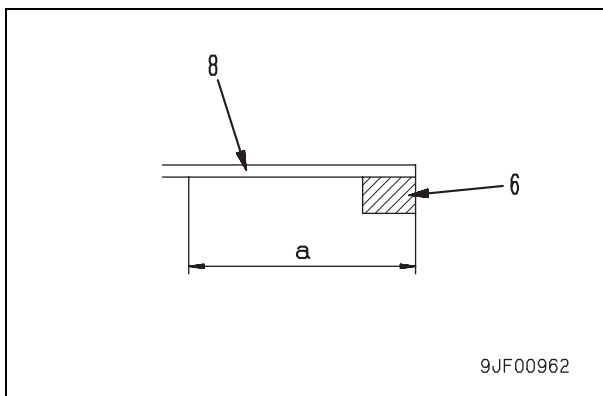
 Paint primer:

**SUNSTAR PAINT PRIMER 580
SUPER or equivalent**

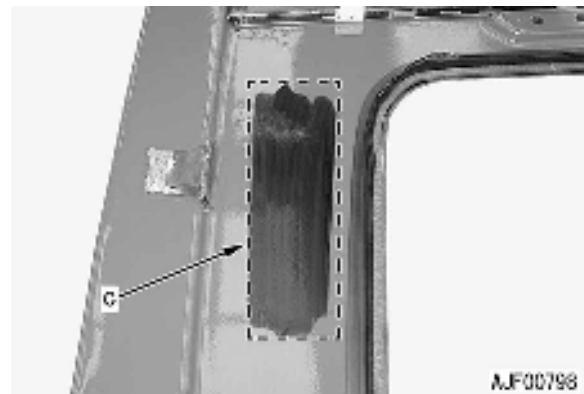
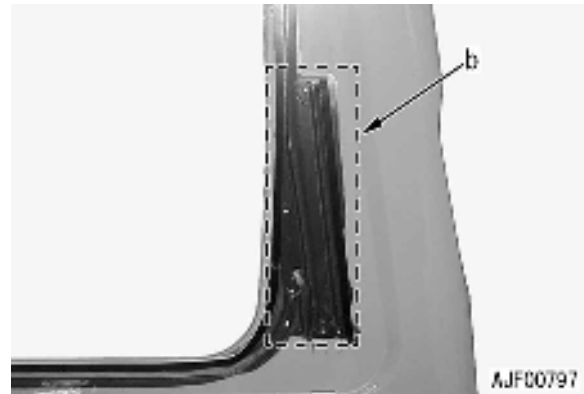
- ★ Do not apply the primer more than 2 times. (If it is applied more than 2 times, its performance will be lowered.)



- ★ Parts to be coated with primer: Apply the primer all over dimension (a).
- Dimension to apply primer (a): **25 mm**




- ★ In addition to the above parts, apply the primer to right side window glass (1) and door lower window glass (3).
- Range to apply primer additionally for right side window glass (1): (b)
- Range to apply primer additionally for door lower window glass (3): (c)
- ★ After applying the primer, leave it for at least 5 minutes (within 8 hours) to dry.



- ★ Never apply wrong primer. If the glass primer is applied by mistake, wipe it off with white gasoline.

- 4) Evenly apply glass primer to the sticking surfaces of window glass (9).

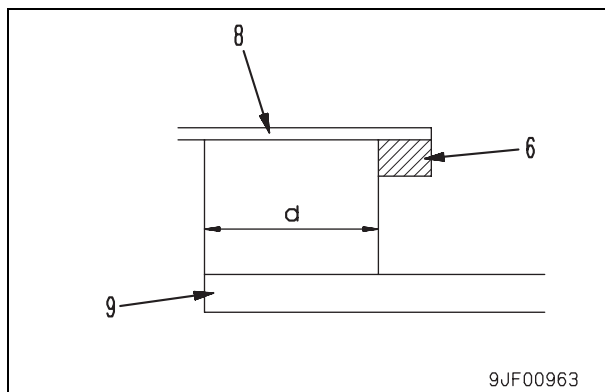
 Glass primer:

**SUNSTAR GLASS PRIMER 580
SUPER or equivalent**

- ★ Do not apply the primer more than 2 times. (If it is applied more than 2 times, its performance will be lowered.)

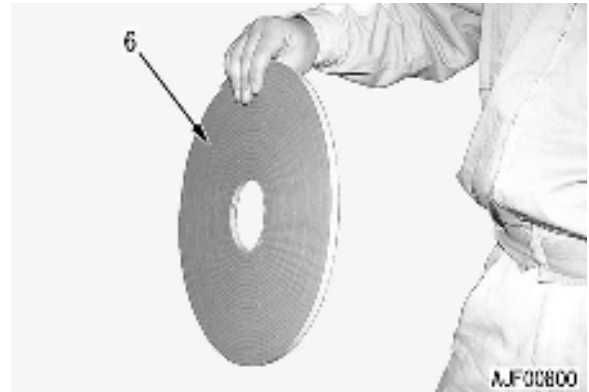


- ★ Parts to be coated with primer: Apply the primer to the sticking surfaces of window glass (9) and all over dimension (d) which will be on double-sided adhesive tape (6) and operator's cab (8).
- ★ Do not apply the primer to the boarder about 5 mm wide between the black part and transparent part of the glass.
- ★ After applying the primer, leave it for at least 5 minutes (within 8 hours) to dry.
- ★ Never apply wrong primer. If the glass primer is applied by mistake, wipe it off with white gasoline.



4. Stick double-sided adhesive tape (6) along the inside edge of the glass sticking section.

- ★ Do not remove the release tape of the double-sided adhesive tape on the glass sticking side before sticking the glass.
- ★ When sticking the double-sided adhesive tape, do not touch the cleaned surface as long as possible.
- ★ Take that the double-sided adhesive tape will not float at each corner of the window frame.



- ★ When sticking double-sided adhesive tape (6) around a frame, do not lap its finishing end over the starting end but make clearance e of about 5 mm between them.
- 1) Stick double-sided adhesive tape (6) for right side window glass (1) as shown in the figure.



- ★ Stick double-sided adhesive tape (6a) additionally for right side window glass (1).
- Positions to stick additional double-sided adhesive tape for right side window glass:
 - (f) : **50 mm**
 - (g) : **90 mm**
 - (h) : **250 mm**



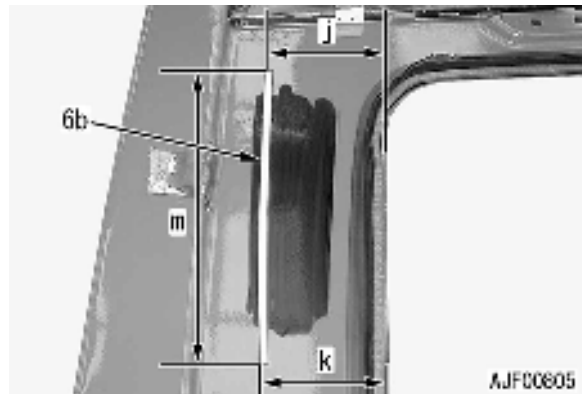
- 2) Stick double-sided adhesive tape (6) for left side rear window glass (2) as shown in the figure.



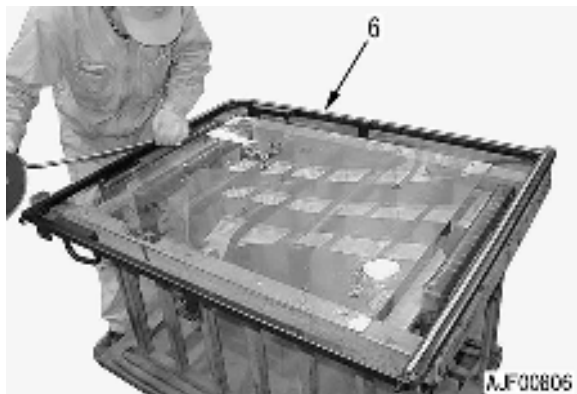
- 3) Stick double-sided adhesive tape (6) for door lower window glass (3) as shown in the figure.



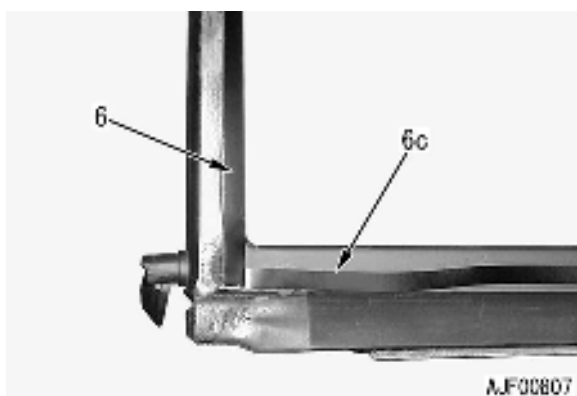
- ★ Stick double-sided adhesive tape (6b) additionally for door lower window glass (3).
- ★ Positions to stick additional double-sided adhesive tape for door lower window glass:
 - (j) : **110 mm**
 - (k) : **90 mm**
 - (m) : **200 mm**



- 4) Stick double-sided adhesive tape (6) for front window glass (4) as shown in the figure.

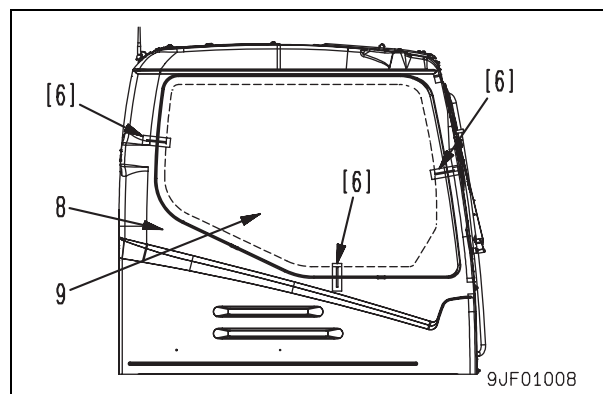
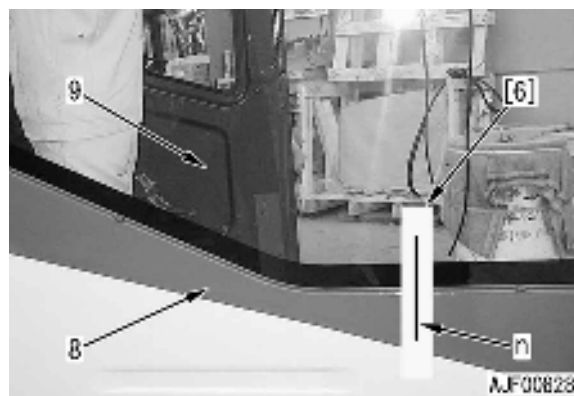


- ★ Stick double-sided adhesive tape (6c) of the lower side of the front window glass along the outside edge of the lower line, differently from other double-sided adhesive tapes (6). (If it is stuck along the inside, it will be seen through the transparent part of the glass.)

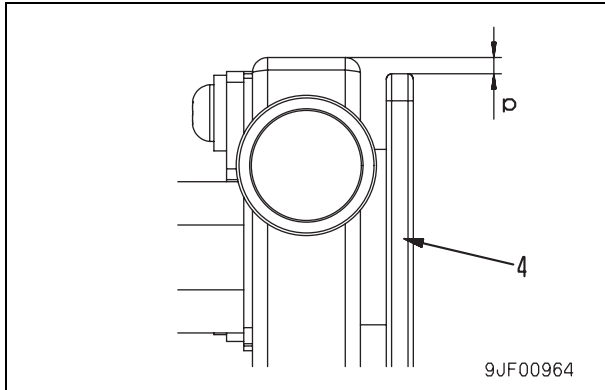


5. Position the new window glass.

- 1) Check the clearance between the window glass and the operator's cab on the right, left, upper, and lower sides, and then adjust it evenly.
- 2) Stick tapes [6] between window glass (9) and operator's cab (8) and draw positioning line (n).
- ★ Stick tapes [6] to the right, left, and lower parts of the right side window glass, left side rear window glass, and door lower window glass for accurate positioning.
- 3) Cut the tape between window glass (9) and operator's cab (8) with a knife, and then remove the window glass.
- ★ Do not remove the tapes left on the window glass and operator's cab before installing the window glass.



- ★ When positioning front window glass (4), set its horizontal position to the frame width and set its vertical position so that height difference (p) between it and the frame top will be 3 mm.



6. Apply adhesive.

- ★ Use either of the 2 types of the adhesive.

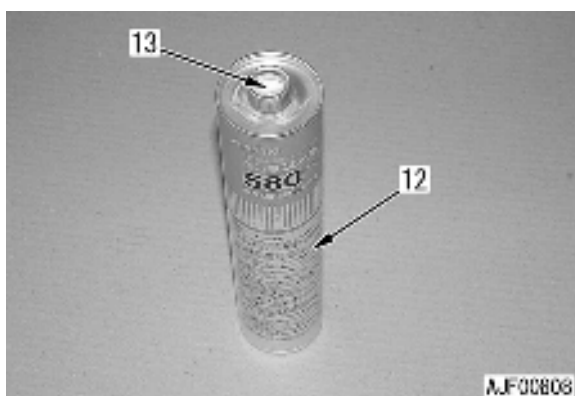
 Adhesive (Summer):

SUNSTAR PENGUINE SEAL 580 SUPER "S"

 Adhesive (Winter):

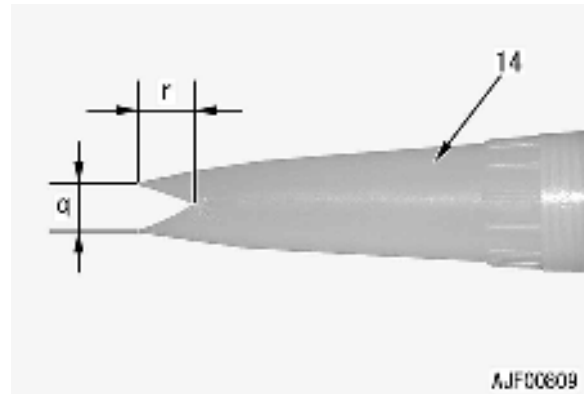
SUNSTAR PENGUINE SEAL 580 SUPER "W"

- ★ The using limit of the adhesive is 4 months after the date of manufacture. Do not use the adhesive after this limit.
 - ★ Keep the adhesive in a dark place where the temperature is below 25 °C.
 - ★ Never heat the adhesive higher than 30 °C.
 - ★ When reusing the adhesive, remove the all hardened part from the nozzle tip.
- 1) Break aluminium seal (13) of the outlet of adhesive cartridge (12) and install the nozzle.



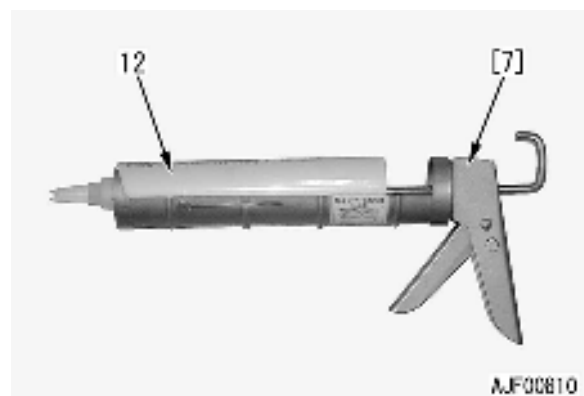
- 2) Cut the tip of the adhesive nozzle (14) so that dimensions (q) and (r) will be as follows.

- Dimension (q): 10 mm
- Dimension (r): 15 mm



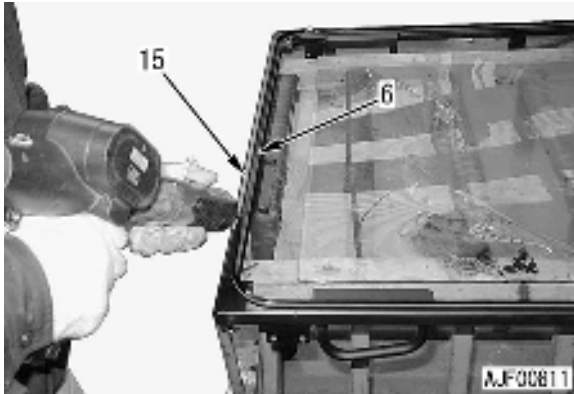
- 3) Set adhesive cartridge (12) to caulking gun [7].

- ★ An electric caulking gun is more efficient.

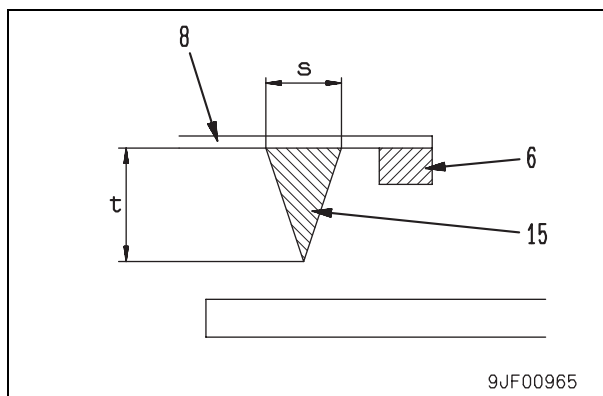


- 4) Remove the release tape of the double-sided adhesive tape on the glass side.

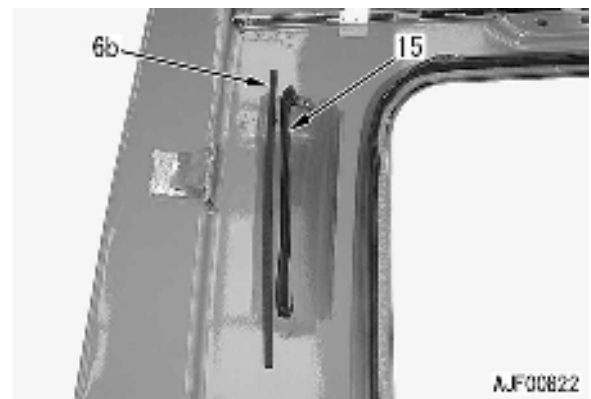
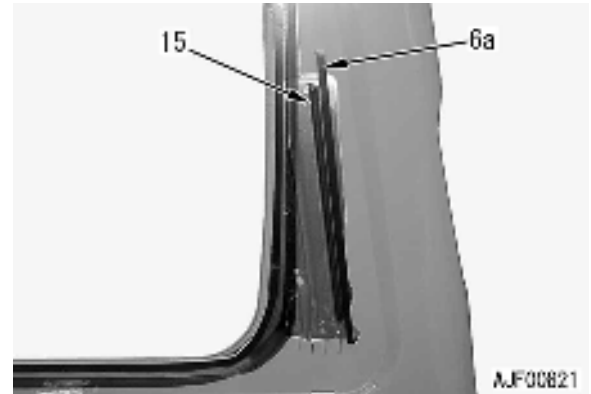
- 5) Apply adhesive (15) to the outside of double-sided adhesive tape (6) of the operator's cab.



- ★ Apply adhesive (15) to dimensions (s) and (t) of double-sided adhesive tape (6) of operator's cab (8).
 - Dimension (s) : 10 mm
 - Dimension (t) : 15 mm
- ★ Apply adhesive (15) higher than double-sided adhesive tape (6).
- ★ Apply the adhesive evenly.



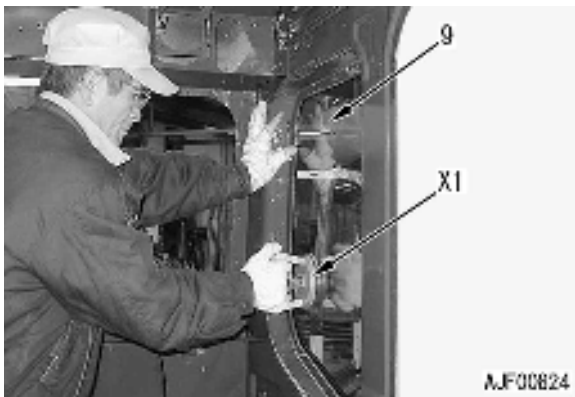
- ★ Apply adhesive (15) additionally for additional double-sided adhesive tape (6a) of the right side window glass and additional double-sided adhesive tape (6b) of door lower window glass.



7. Install the window glass.
 - 1) Install window glass (9), matching it to the lines of the positioning tapes drawn in step 5.
 - ★ Since the window glass cannot be removed and stuck again, stick it very carefully.
 - ★ Stick the glass within 5 minutes after applying the adhesive.
 - 2) After sticking window glass (9), press all around it until it is stuck to the double-sided adhesive tape.
 - ★ Press the corners of the window glass firmly.



- ★ You can perform this work efficiently by pulling window glass (9) from inside of the operator's cab with suction cup **X1**.



- ★ After installing front window glass (4), fill the clearances between it and centre trim seal (16) with caulking material in range (s) to dimensions (t) and (u).

After applying the primer to glass (4) of section A - A, apply adhesive as caulking material.

- Caulking dimension (t) : **2 mm**
- Caulking dimension (u) : **5 mm**

- ★ When caulking, mask the glass side and form the adhesive with a rubber spatula as shown in the figure.

- ★ Wipe off projected adhesive.



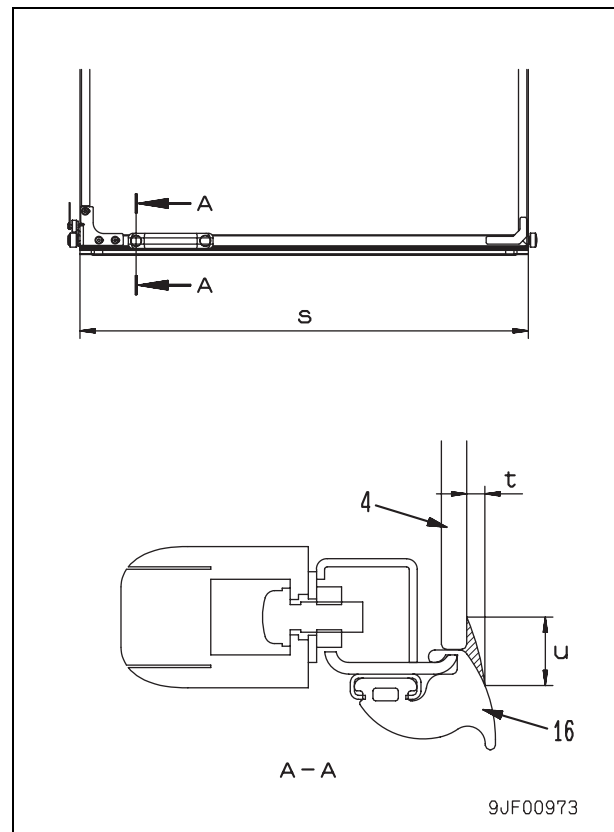
Glass primer:

SUNSTAR GLASS PRIMER 580 SUPER



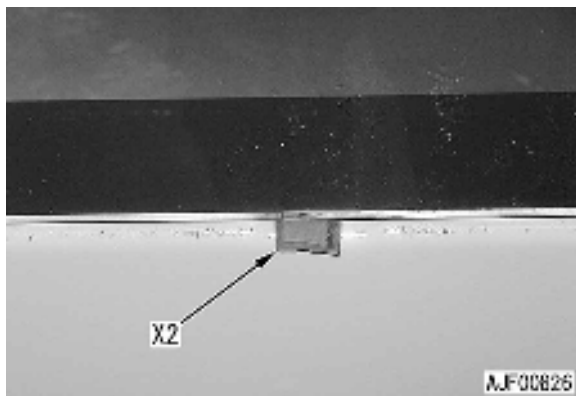
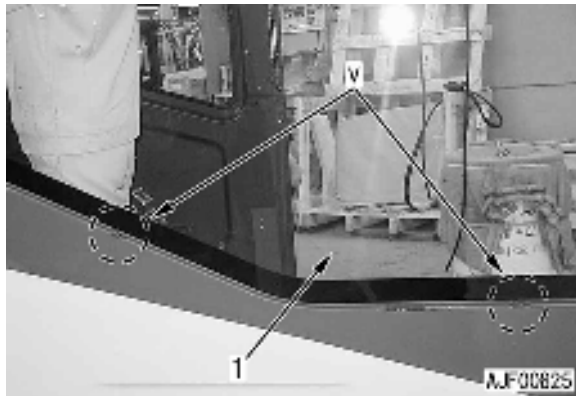
Adhesive:

SUNSTAR PENGUINE SEAL 580 SUPER "S" or "W"



8. Fix the window glass.

- 1) After installing right window glass (1) to the operator's cab, insert stopper rubbers **X2** to 2 places (v) at the bottom of the glass to fix the glass.



- 2) Using styrene foam blocks [9] and rubber bands [10], fix the window glass and double-sided adhesive tape to fit them completely.



9. After installing the window glass, remove the primer and adhesive from the operator's cab and window glass.

- ★ Using white gasoline, wipe off the adhesive before it is dried up.
- ★ When cleaning the glass, do not give an impact to it.

10. Protect the stuck window glass.

- 1) Keep the stopper rubbers, styrene foam blocks, and rubber bands installed for 10 hours (at temperature of 20 °C and humidity of 60 %).
- 2) After removing the stopper rubbers, styrene foam blocks, and rubber bands, wait at least 14 hours, at least 24 hours in total, before operating the machine actually.

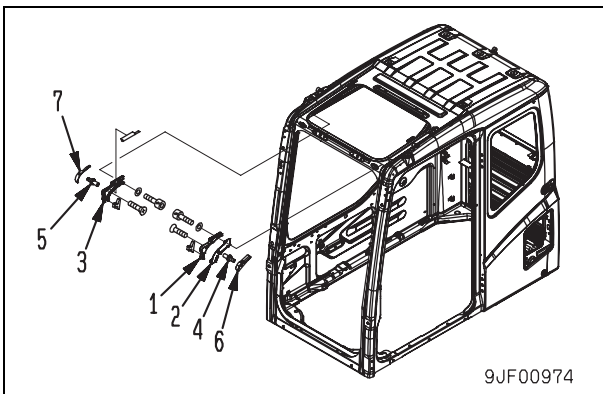
Removal and installation of front window assembly

⚠ Lower the work equipment to the ground and stop the engine.

- ★ To replace the front window glass, the front window assembly must be removed from the operator's cab. The procedure for removing and installing the front window assembly (front frame and front window glass) is explained below.

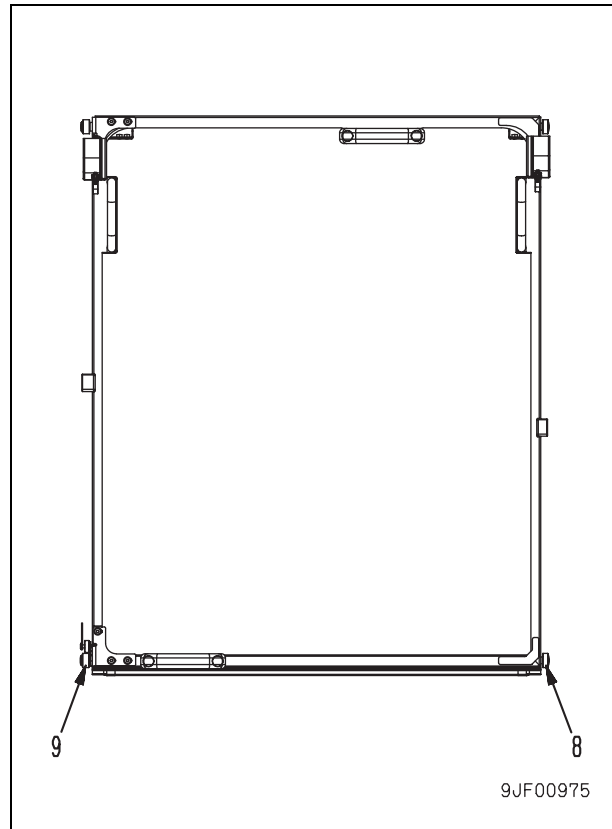
Removal

1. Raise the front window assembly to the ceiling and fix it with the rear locks (on both sides).
2. Remove left corner blocks (1) and (2) and right corner block (3). [*1]
3. Remove left striker bolt (4), right striker bolt (5), left corner block bracket, and right corner block bracket (7). [*2]
4. Install left striker bolt (4) to the operator's cab again and tighten it lightly.
 - ★ This bolt will be used to hang the pull-up assist cable in step 8.

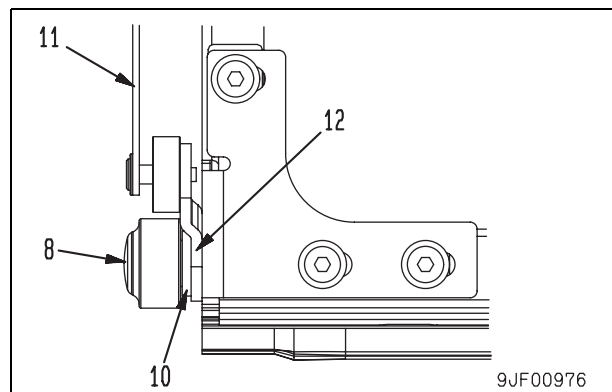


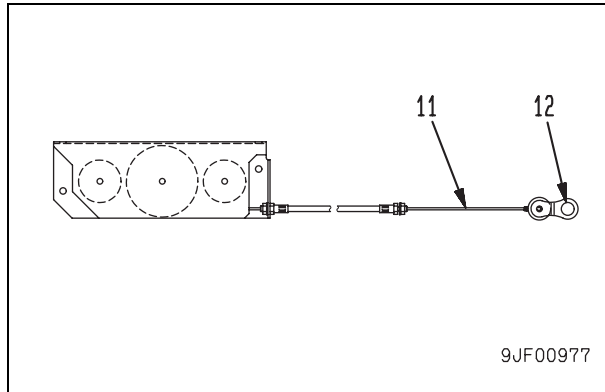
5. Release the rear locks.
6. Lower the front window assembly carefully a little. Put out rollers (8) and (9) under the both sides of the front window through the portion from which the corner blocks were removed in step 3 (the portion where the rail is open) and hold them.

7. Remove rollers (8) and (9) under the both sides of the front window.

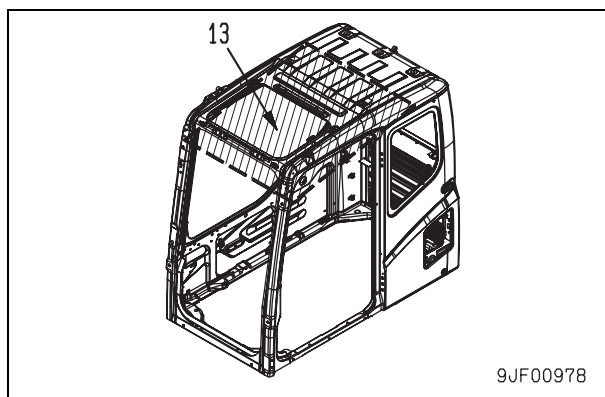


8. Remove left lower pin (10). [*3]
 - ★ If left lower pin (10) is removed, plate (12) at the end of pull-up assist cable (11) comes off.
 - ★ Hang plate (12) on the left striker bolt.
 - ⚠ The return load of 58.8 N {6 kg} is applied to the rear of the operator's cab. Accordingly, take care when removing left lower pin (10) to disconnect pull-up assist cable (11).

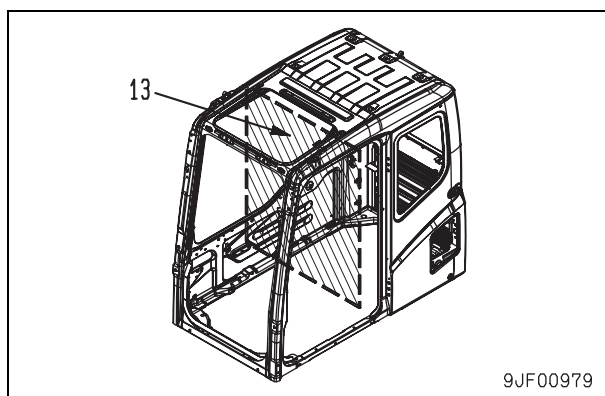




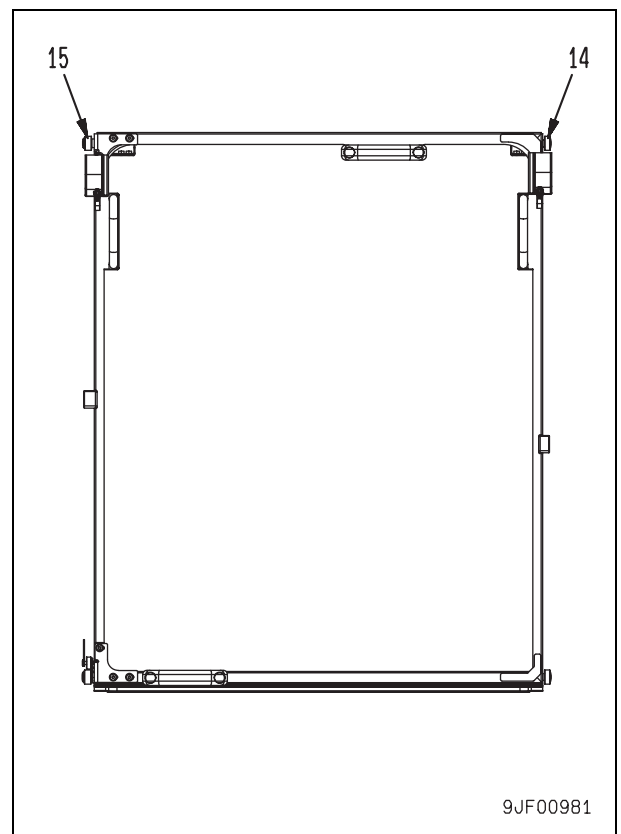
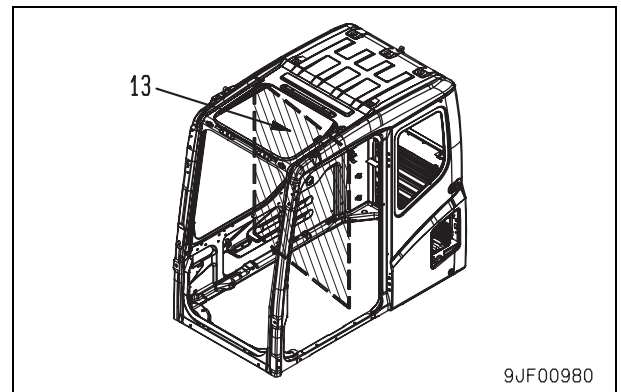
9. Put out the bottom of front window assembly (13) through the rail opening portion and lower it gradually.



10. Lower front window assembly (13) completely.
★ Do not let the front window assembly touch the monitor.



11. Twist front window assembly (13) to the right and left to remove both upper rollers (14) and (15) from the rails, and then remove front window assembly (13).



Installation

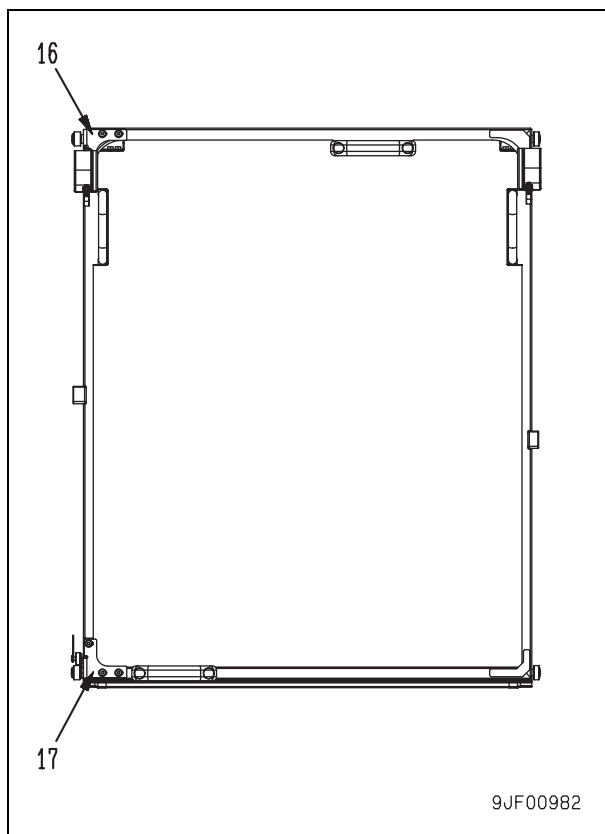
- Carry out installation in the reverse order to removal.

[*1] [*2]

- Adjust opening and closing of the front window assembly according to the following procedure.

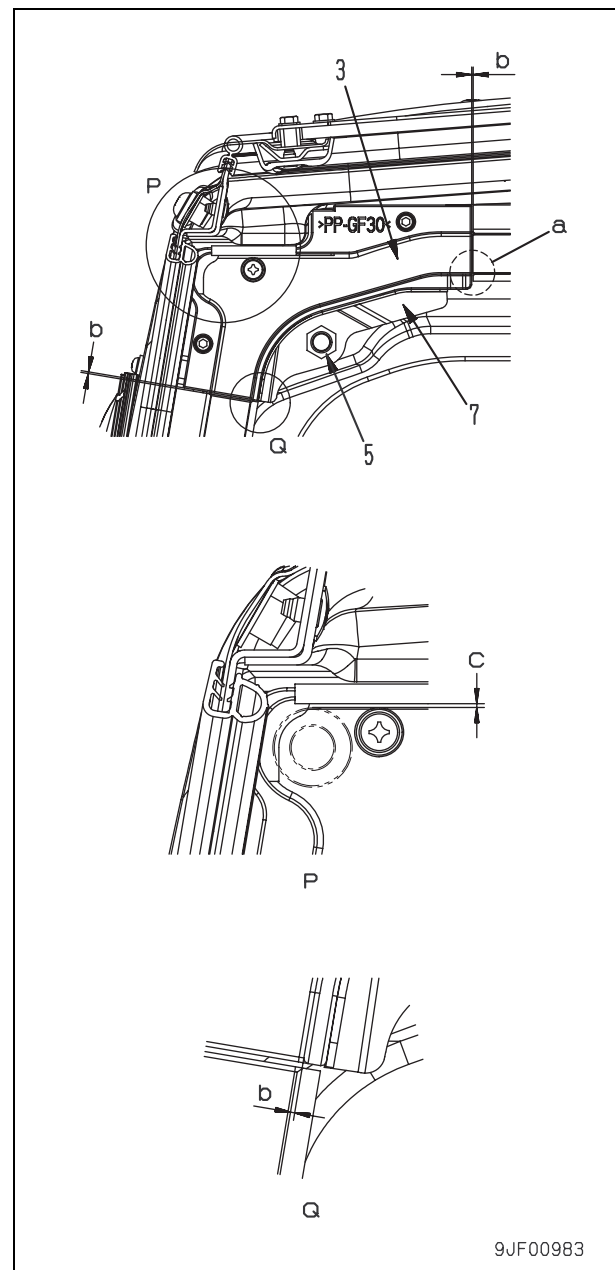
1. Open and close the front window to check that it does not interfere with the rails and the rollers are not hitch.
2. If there is any problem in opening or closing of the front window, loosen the mounting bolts of roller adjustment brackets (16) and (17) and adjust the condition of the front window, and then tighten the mounting bolts again.

⚙ Mounting bolt: **98 Nm {1.0 kgm}**

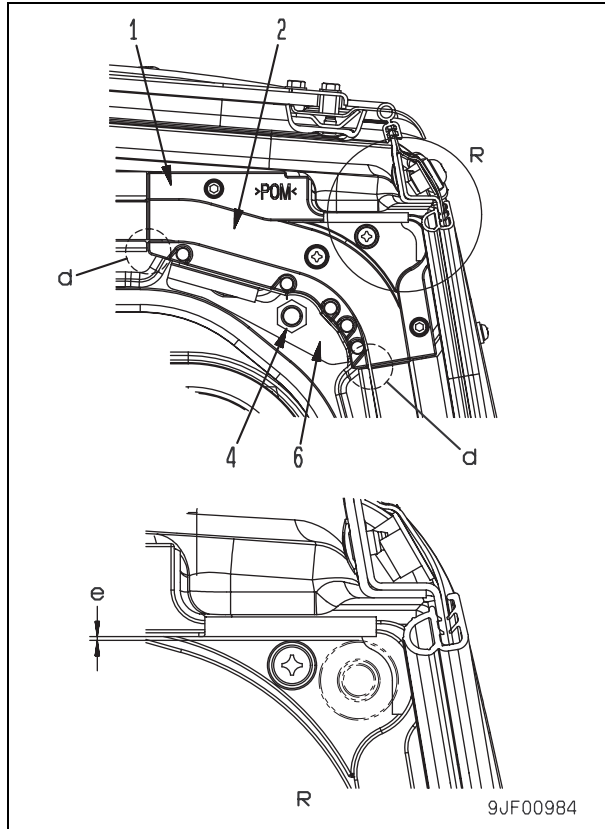


3. Raise the front window assembly and fix it with the rear locks (on both sides).
 - ★ Check that the locks in the rear of the operator's cab are applied securely.

4. Install right corner block (3) and fix right corner block bracket (7) with right striker bolt (5).
 - ★ Tighten the striker bolt securely after adjusting it in step 6.
 - ★ Install the right corner block so that there will be no level difference at part (a).
 - ★ Install the right corner block so that level difference (b) between the rail and right corner block (3) will be 0 – 1.0 mm. Check that the right corner block is not projected from the rail at the rolling surface of the roller.
 - ★ Secure roller clearance (c) at part (P).

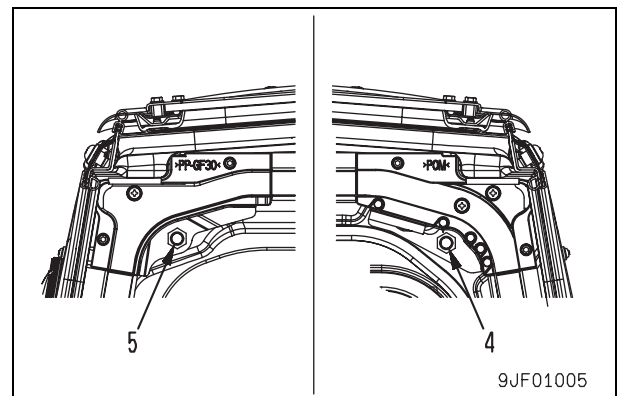
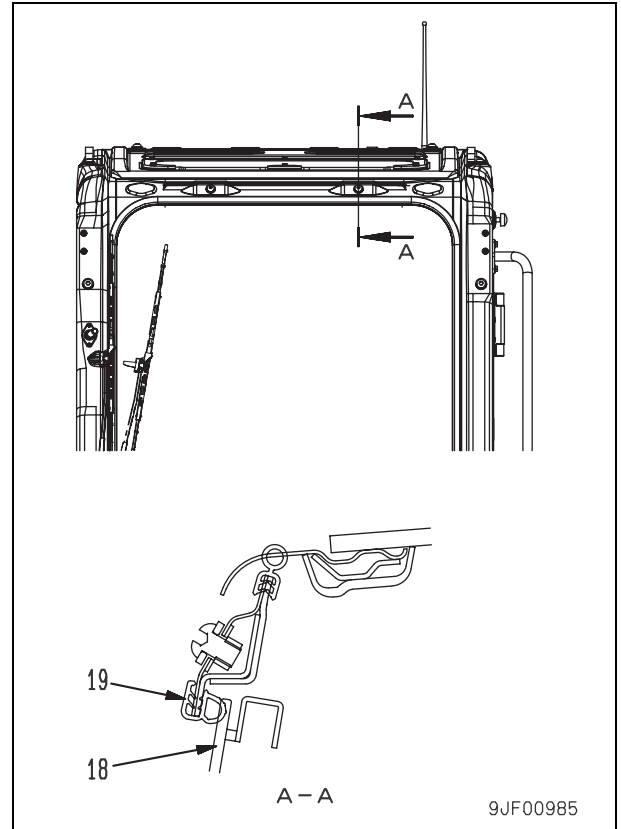


5. Install left corner blocks (1) and (2) and secure left corner bracket (6) with left striker bolt (4).
 - ★ Tighten the striker bolt securely after adjusting it in step 6.
 - ★ Install the left corner blocks so that there will be no level difference at 2 part (d).
 - ★ Secure roller clearance (e).

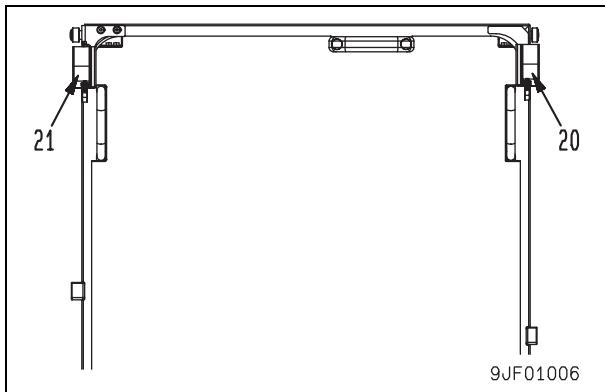


6. Adjust the striker bolts according to the following procedure (Adjust the "CLOSE" positions of the front window assembly locks).

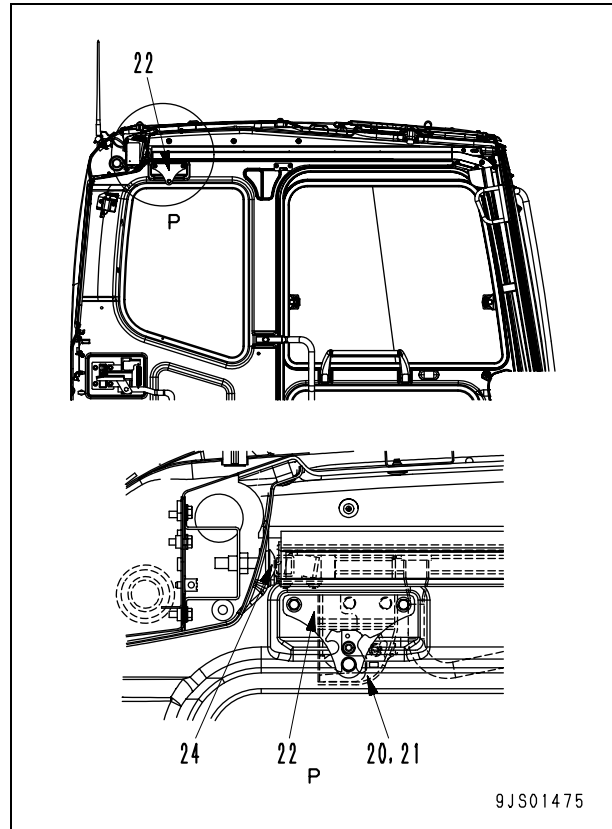
- 1) Tighten left striker bolt (4) and right striker bolt (5) at roughly right positions so that front window glass (18) will be fitted to cab-side trim seal (19).



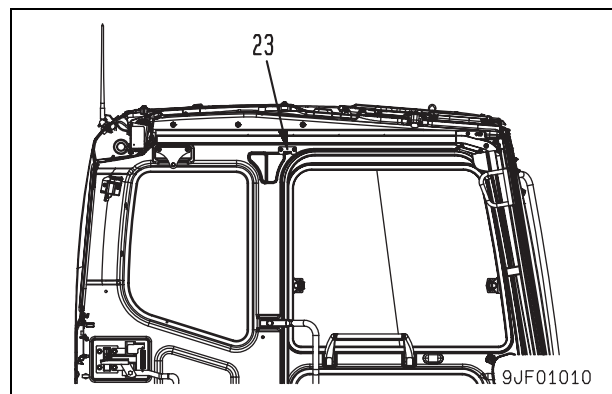
- 2) Open and close the front window assembly and check the working condition of both locks (20) and (21).
 - i) If both locks do not work normally, move the striker bolts toward the rear of the cab and tighten them again.
 - ii) After moving the striker bolts, check the fitness of the front window glass and cab-side trim seal which was checked in step 1).
 - iii) Repeat the work in i) and ii) until the fitness of the front window and the working condition of both locks (20) and (21) are acceptable, and then tighten the striker bolts.



7. After adjusting the striker bolts, splash water heavily over the front window glass and check that the water does not leak into the cab.
8. Adjust the "opening" lock of the front window assembly.
 - 1) After adjusting the "closing" lock of the front window in steps 6 and 7, raise the front window assembly to the ceiling.
 - 2) Set the right and left front window assembly locks at the rear of the operator's cab to the "OPEN" positions, and then check the following items.
 - Check that right and left locks (20) and (21) are closed normally.
 - Check that right and left locks (20) and (21) are inserted in parallel in right and left striker plates (22).
 - Check that right and left rubber stoppers (24) are in contact with the front window assembly and their deflection allowance is 1.5 - 3.0 mm.
 - 3) After checking the above items, if necessary, adjust them by moving right and left striker plates (22) at the rear of the operator's cab.

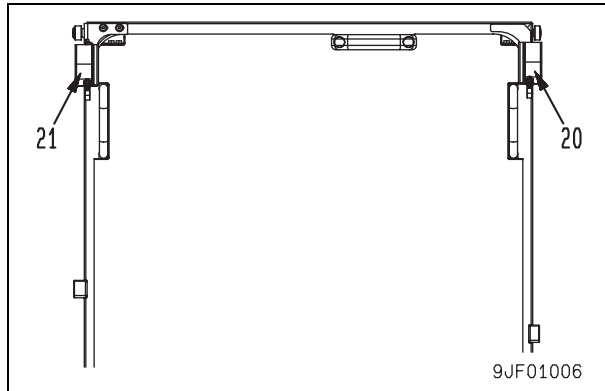


9. Adjust the front window stoppers.
 - 1) After adjusting "closing" lock of the front window assembly in step 8, check the contact of both front window stoppers (23).
 - 2) If both stoppers (23) do not contact normally, adjust and fix them at places where they contact normally.




10. Check the latching effort of the front window assembly.

- 1) After finishing steps 6 – 9, check that latching efforts of both locks (20) and (21) are even.
- ★ Check the latching efforts on both "closing" side (in the front of the operator's cab) and "opening" side (in the rear of the operator's cab).



[*3]

 Left lower pin:

27 – 34 Nm {2.75 – 3.47 kgm}

 Mounting bolt: **Adhesive (LT-2)**

Removal and installation of floor frame assembly

Special tools

Sym- bol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
S	799-703-1200	Service tool KIT	■	1		
	799-703-1100	Vacuum pump (100 V)	■	1		
	799-703-1111	Vacuum pump (220 V)	■	1		
	799-703-1121	Vacuum pump (240 V)	■	1		
	799-703-1401	Gas leak detector	■	1		

Removal


- ⚠ **Stop the machine on a level ground, lower the work equipment to the ground, stop the engine, and set the lock lever in the lock position.**
- ⚠ **Disconnect the cable from the negative (-) terminal of the battery.**
- ⚠ **Loosen the hydraulic tank cap gradually to release the residual pressure in the hydraulic tank.**
- ⚠ **Collect the air conditioner refrigerant gas with the special tools.**

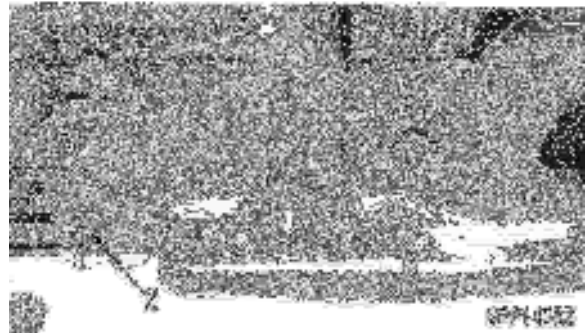
- ★ Put tags to the disconnected piping to prevent a mistake in re-connecting them.

1. Remove undercover (1).



2. Open coolant drain valve (2) to drain the coolant.

 Coolant: 18.5 ℓ



3. Remove the operator's cab assembly. For details, see "Removal of operator's cab assembly".

4. Disconnection of wiring and hoses under the floor

- 1) Disconnect left wiring connectors (3) – (6) and right wiring connectors (7) – (10).

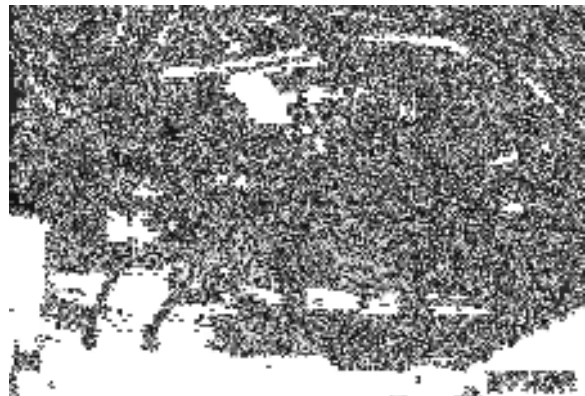
Left side Right side

(3): A01 (7): A03

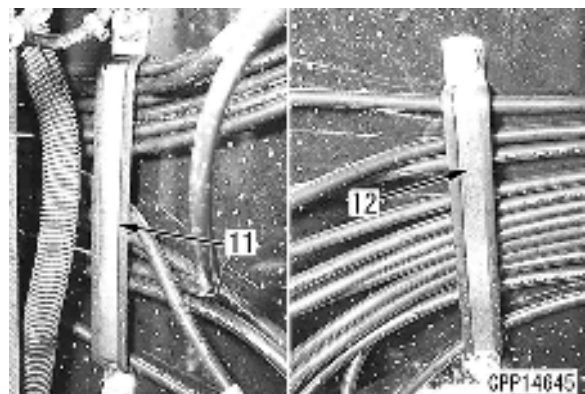
(4): A02 (8): A06

(5): A05 (9): A09

(6): A07 (10): A04



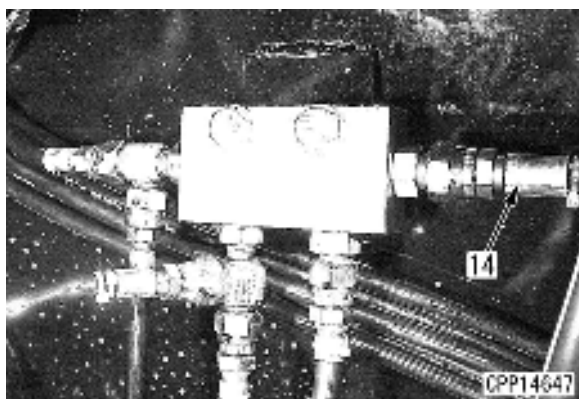
- 2) Remove centralized hose clamps (11) and (12).



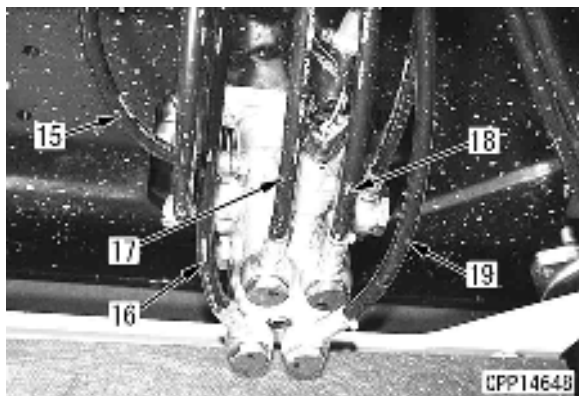
- 3) Disconnect hose (13) from the port-P centralized block.



- 4) Disconnect hose (14) from port-T centralized block



- 5) Disconnect travel PPC hoses (15) – (19).



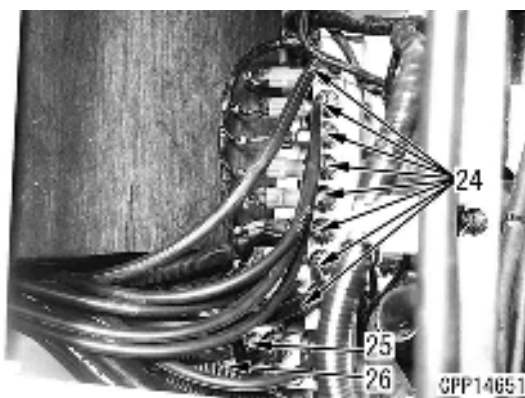
- 6) Disconnect air conditioner wiring connector P17 (20).
- 7) Disconnect 2 air conditioner hoses (21).
[*1]
- 8) Disconnect 2 heater hoses (22).



- 9) Disconnect ground wire (23).



5. Disconnect 8 PPC hoses (24).
6. Disconnect PPC attachment hoses (25) and (26) (if equipped).



7. Lift off floor frame assembly (27).

- ★ When slinging, check that all the wiring and hoses are disconnected.



Floor frame assembly: **Approx. 210 kg**

**Installation**

- Carry out installation in the reverse order to removal.

[*1]

- ★ When installing the air conditioner circuit hoses, take care that dirt, dust, water, etc. will not enter them.
- ★ When connecting each air conditioner hose, check that the O-ring is fitted to its adapter.
- ★ Check that each O-ring is not damaged or deteriorated.
- ★ When fitting each O-ring, apply compressor oil (DENSO: ND-OIL8, ZEXEL: ZXL100PG (Equivalent to PAG46) to it.

Mounting bolt:

8 – 12 Nm {0.8 – 1.2 kgm}

- Charging air conditioner with refrigerant gas
Using tool **S**, charge the air conditioner circuit with refrigerant gas (R134a).
★ Filling quantity: 800 (+50/0) g

PC160LC-7E0, PC180LC/NLC-7E0 Hydraulic Excavator

Form No. UEN02453-00

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HYDRAULIC EXCAVATOR

PC160LC-7E0

PC180LC-7E0

PC180NLC-7E0

Machine model	Serial number
---------------	---------------

PC160LC-7E0	K45001 and up
PC180LC-7E0	K45001 and up
PC180NLC-7E0	K45001 and up

50 Disassembly and assembly

Electrical system

Removal and installation of air conditioner compressor assembly	2
Removal and installation of air conditioner condenser	3
Removal and installation of air conditioner unit assembly	4
Removal and installation of machine monitor assembly	6
Removal and installation of governor, pump controller assembly	7
Removal and installation of engine controller assembly	8
Removal and installation of KOMTRAX assembly	9

Removal and installation of air conditioner compressor assembly

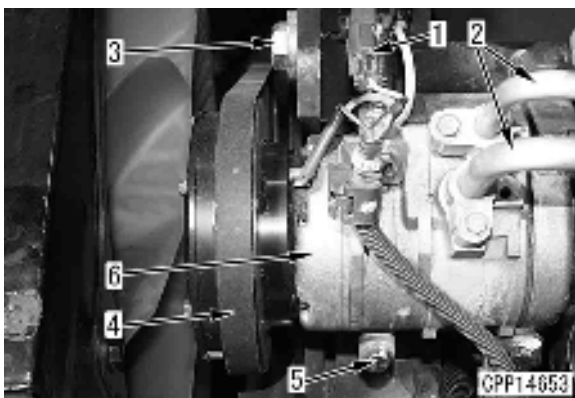
Special tools

Symbol	Part No.	Part name	Necessity	Qty	New/Remodel	Sketch
S	799-703-1200	Service tool KIT	■	1		
	799-703-1100	Vacuum pump (100 V)	■	1		
	799-703-1111	Vacuum pump (220 V)	■	1		
	799-703-1121	Vacuum pump (240 V)	■	1		
	799-703-1401	Gas leak detector	■	1		

Removal

- ⚠ Stop the machine on a level ground, lower the work equipment to the ground, stop the engine, and set the lock lever in the lock position.
- ⚠ Disconnect the cable from the negative (–) terminal of the battery.
- ⚠ Collect the air conditioner refrigerant gas with the special tools.

1. Disconnect wiring connector A02 (1).
2. Disconnect air conditioner piping (2). [*1]
3. Loosen 2 drive belt adjustment bolts (3).
4. Remove drive belt (4).
5. Remove 4 mounting bolts (5) and air conditioner compressor assembly (6). [*2]



Installation

- Carry out installation in the reverse order to removal.

[*1]

• Precautions for installing piping

- ★ When installing the air conditioner circuit hoses, take care that dirt, dust, water, etc. will not enter them.
- ★ When connecting each air conditioner piping, apply compressor oil (DENSO: ND-OIL8 or equivalent) to its threaded part.

⌚ Mounting bolt:

8 – 12 Nm {0.8 – 1.2 kgm}

• Charging air conditioner with refrigerant gas

- Using tool **S**, charge the air conditioner circuit with refrigerant gas (R134a).
- ★ Filling quantity: 800 (+50/0) g

[*2]

Air conditioner compressor mounting bolt:

24.5 – 29 Nm {2.5 – 3.0 kgm}

Removal and installation of air conditioner condenser

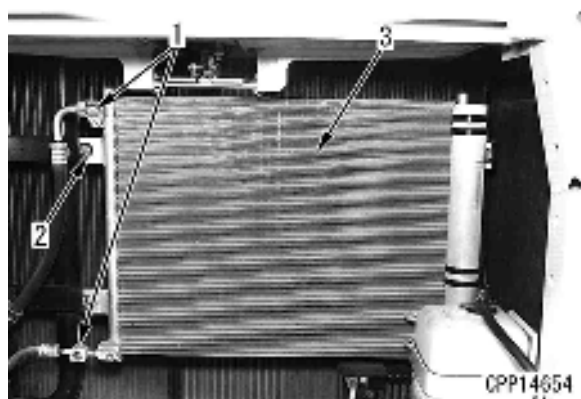
Special tools

Sym-bol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
S	799-703-1200	Service tool KIT	■	1		
	799-703-1100	Vacuum pump (100 V)	■	1		
	799-703-1111	Vacuum pump (220 V)	■	1		
	799-703-1121	Vacuum pump (240 V)	■	1		
	799-703-1401	Gas leak detector	■	1		

Removal

- ⚠ **Stop the machine on a level ground, lower the work equipment to the ground, stop the engine, and set the lock lever in the lock position.**
- ⚠ **Disconnect the cable from the negative (–) terminal of the battery.**
- ⚠ **Collect the air conditioner refrigerant gas with the special tools.**

1. Disconnect air conditioner piping (1). [*1]
2. Remove 4 mounting bolts (2) and air conditioner condenser.



Installation

- Carry out installation in the reverse order to removal.

[*1]

- **Precautions for installing piping**

- ★ When installing the air conditioner circuit hoses, take care that dirt, dust, water, etc. will not enter them.
- ★ When connecting each air conditioner piping, apply compressor oil (DENSO: ND-OIL8 or equivalent) to its threaded part.

🔧 Mounting bolt:

8 – 12 Nm {0.8 – 1.2 kgm}

- **Charging air conditioner with refrigerant gas**

Using tool **S**, charge the air conditioner circuit with refrigerant gas (R134a).

- ★ Filling quantity: **800 (+50/0) g**

Removal and installation of air conditioner unit assembly

Special tools

Sym-bol	Part No.	Part name	Necessity	Q'ty	New/Remodel	Sketch
S	799-703-1200	Service tool KIT	■	1		
	799-703-1100	Vacuum pump (100 V)	■	1		
	799-703-1111	Vacuum pump (220 V)	■	1		
	799-703-1121	Vacuum pump (240 V)	■	1		
	799-703-1401	Gas leak detector	■	1		

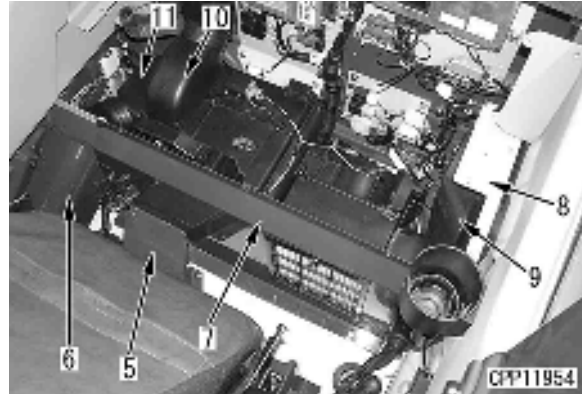
Removal

- ⚠ Swing the upper structure by 90 ° and lower the work equipment to the ground.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.
- ⚠ Collect the air conditioner gas (R134a).

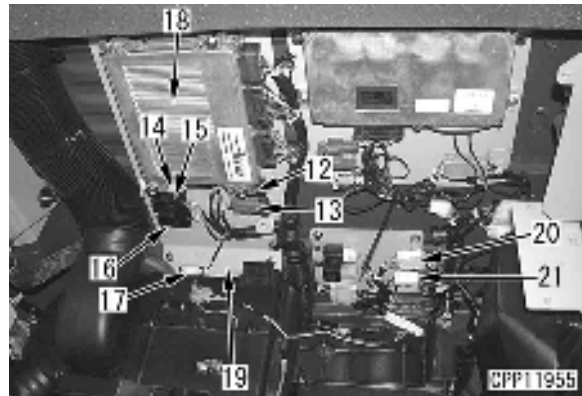
1. Remove rear covers (1), (2), (3), and (4).



2. Remove duct (5), cover (6), and plate (7).
3. Remove plate (8) and duct (9).
 - ★ Remove the duct lock clip.
4. Remove ducts (10) and (11).



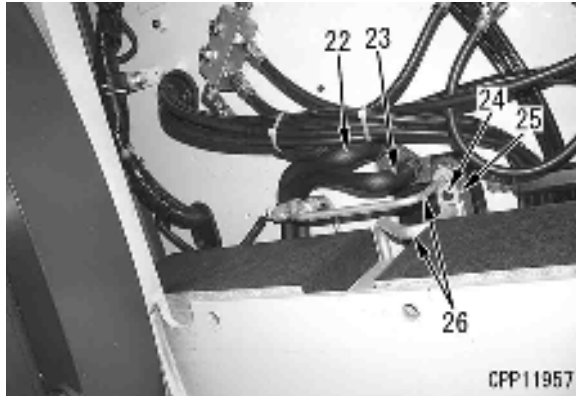
5. Disconnect connectors D01 (12), D02 (13), C09 (14), R22 (15), R20 (16), and K19 (17).
6. Remove and sling controller (18).
7. Remove plate (19).
8. Disconnect air conditioner unit connectors M27 (20) and M33 (21).



9. Remove the air conditioner unit undercover.
 - ★ Part (A)



10. Remove mounting bolt (24) and connector (25). [*1]
11. Disconnect heater hoses (22) and (23) and air conditioner tube (26). [*1]
 - ★ Put tags to the disconnected hoses and tubes to prevent a mistake in re-connecting them.



12. Remove the 7 mounting bolts and air conditioner unit assembly (27).



Installation

- Carry out installation in the reverse order to removal.
- ★ When installing the air conditioner circuit hoses, take care that dirt, water, etc. will not enter them.
- ★ When connecting each air conditioner hose, check that the O-ring is fitted to the joint.
- ★ Check that each O-ring is free from flaw and deterioration.

[*1]

- ★ Apply compressor oil (ND-OIL8) to the threads of the refrigerant pipe joints and tighten each nut with double spanner.

☞ Hose clamp (M6 bolt):

8 – 12 Nm {0.8 – 1.2 kgm}

☞ Hose screw of M16 × 1.5:

12 – 15 Nm {1.2 – 1.5 kgm}

☞ Hose screw of M22 × 1.5:

20 – 25 Nm {2.0 – 2.5 kgm}

☞ Hose screw of M24 × 1.5:

30 – 35 Nm {3.0 – 3.5 kgm}

- **Charging air conditioner with refrigerant gas**

Using tool **S**, charge the air conditioner circuit with refrigerant (R134a).

Removal and installation of machine monitor assembly

Removal

- ⚠ Stop the machine on a level ground, lower the work equipment to the ground, stop the engine, and set the lock lever in the lock position.
- ⚠ Disconnect the cable from the negative (-) terminal of the battery.

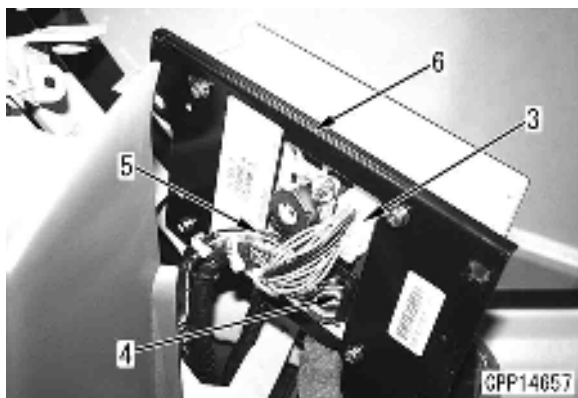
1. Remove cover (1).



2. Remove 3 monitor mounting bolts (2).



3. Disconnect wiring connectors P01 (3), P02 (4) and P70 (5) and remove monitor assembly (6).



Installation

- Carry out installation in the reverse order to removal.

Removal and installation of governor, pump controller assembly

Removal

- ⚠ First, disconnect the cable from the negative terminal (-) of the battery.

1. Remove covers (1), (2) and (3).



2. Disconnect governor, pump controller wiring connectors CP01 (4), CP02 (5) and CP03 (6).
3. Remove the four mounting bolts and remove pump controller assembly (7).



Installation

- Install in reverse order of removal.

Removal and installation of engine controller assembly

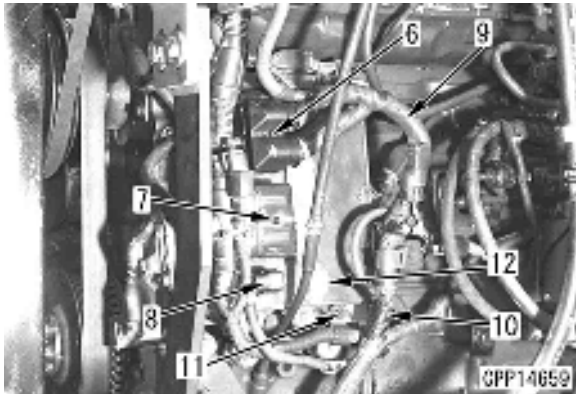
Removal

⚠ Disconnect the cable from the negative (–) terminal of the battery.

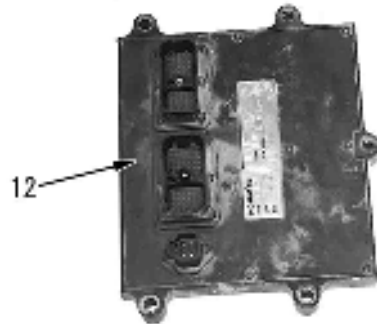
1. Disconnect oil level gauge guide (1) and bracket (2) together.
2. Loosen clamp (3) and disconnect air connector (4).
3. Disconnect clamp (5).



4. Disconnect wiring connectors CE02 (6), ECM (7) and CE03 (8) and clamp.
5. Disconnect the clamp of wiring (9) and (10).



6. Remove 5 mounting nuts (11) and engine controller assembly (12). [*1]

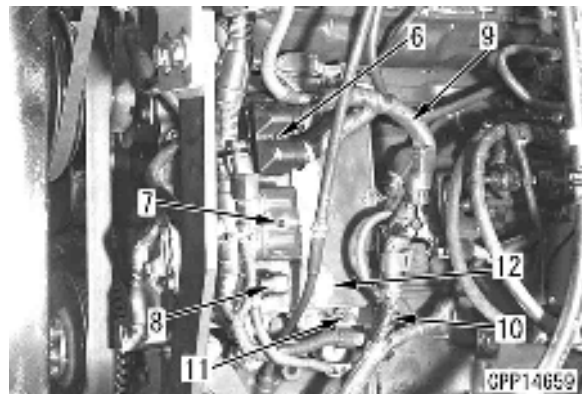


Installation

- Carry out installation in the reverse order to removal.

[*1]

- ★ Wiring (9) is fixed with the 2 upper mounting bolts.
- ★ Wiring (10) is fixed with the 2 lower mounting bolts. The ground wire is fixed with the front bolt.

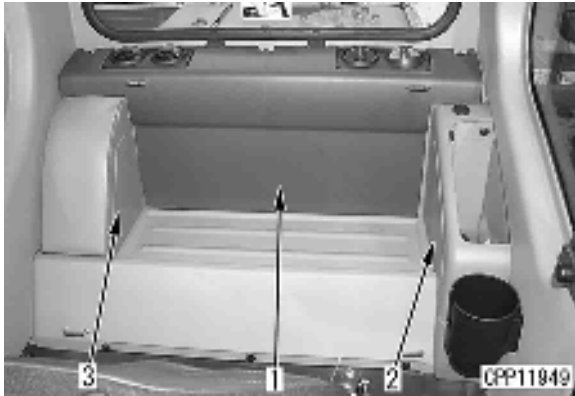


Removal and installation of KOM-TRAX assembly

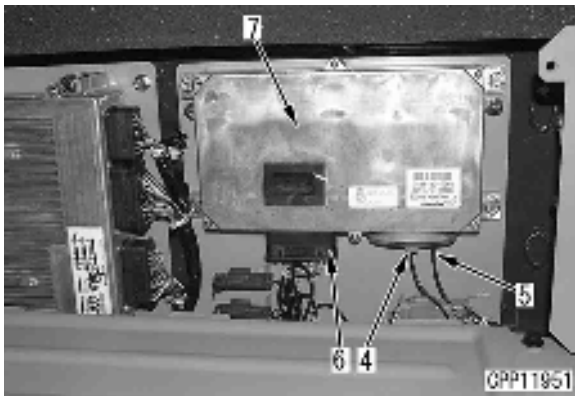
Removal

- ⚠ First, disconnect the cable from the negative terminal (–) of the battery.

1. Remove covers (1), (2) and (3).



2. Disconnect connector (4) for GPS and antenna cable (5).
3. Disconnect connector G01 (6).
4. Remove 4 mounting bolts and then KOMTRAX communication modem assembly.



Installation

- Carry out installation in the reverse order to removal.

PC160LC-7E0, PC180LC/NLC-7E0 Hydraulic Excavator

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HYDRAULIC EXCAVATOR

PC160LC-7E0
PC180LC-7E0
PC180NLC-7E0

Machine model	Serial number
PC160LC-7E0	K45001 and up
PC180LC-7E0	K45001 and up
PC180NLC-7E0	K45001 and up

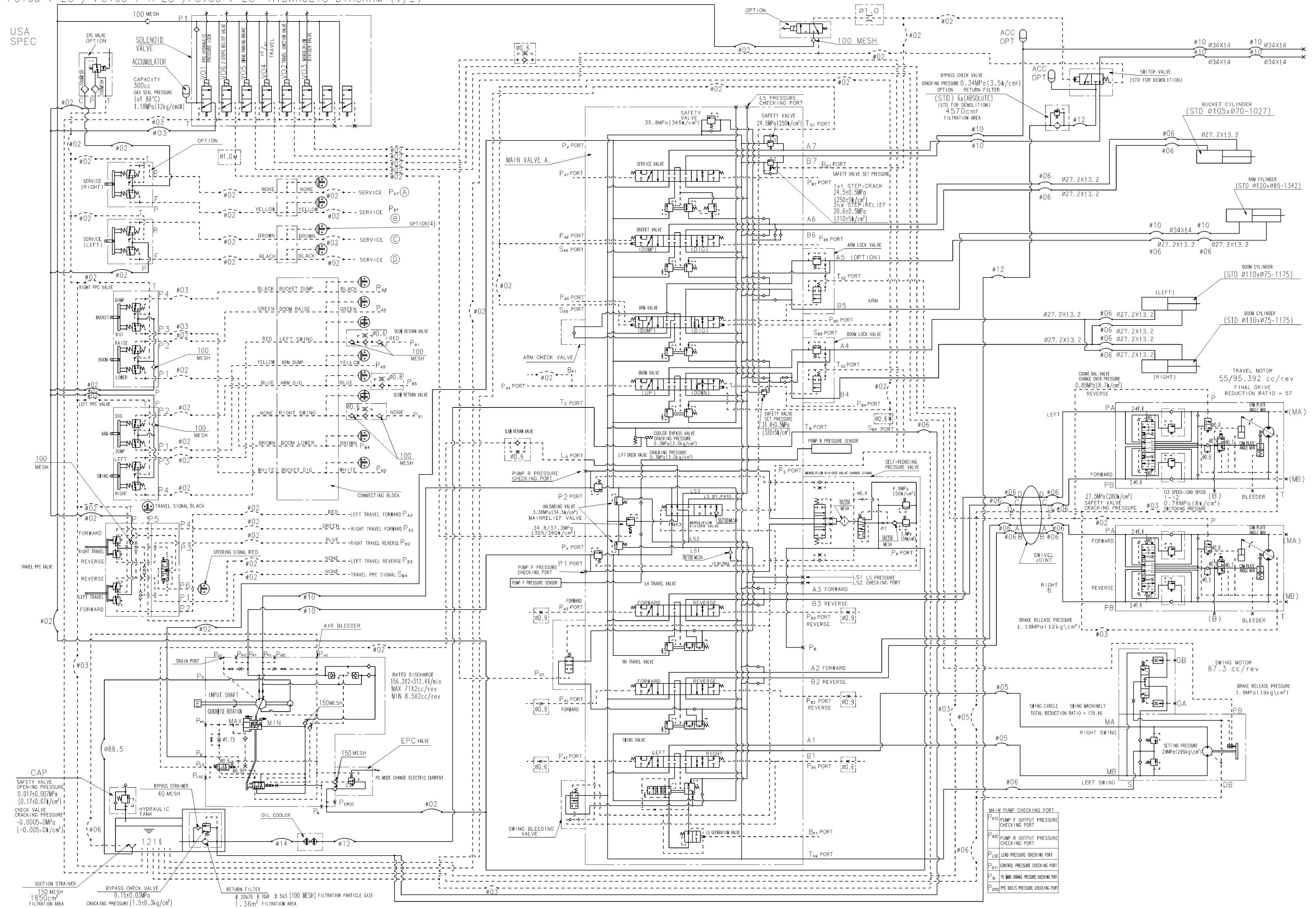
90 Diagrams and drawings

Hydraulic circuit diagram

Hydraulic circuit diagram.....	3
Hydraulic circuit diagram.....	5

Hydraulic circuit diagram 1/2
PC160LC-7E0, PC180LC/NLC-7E0

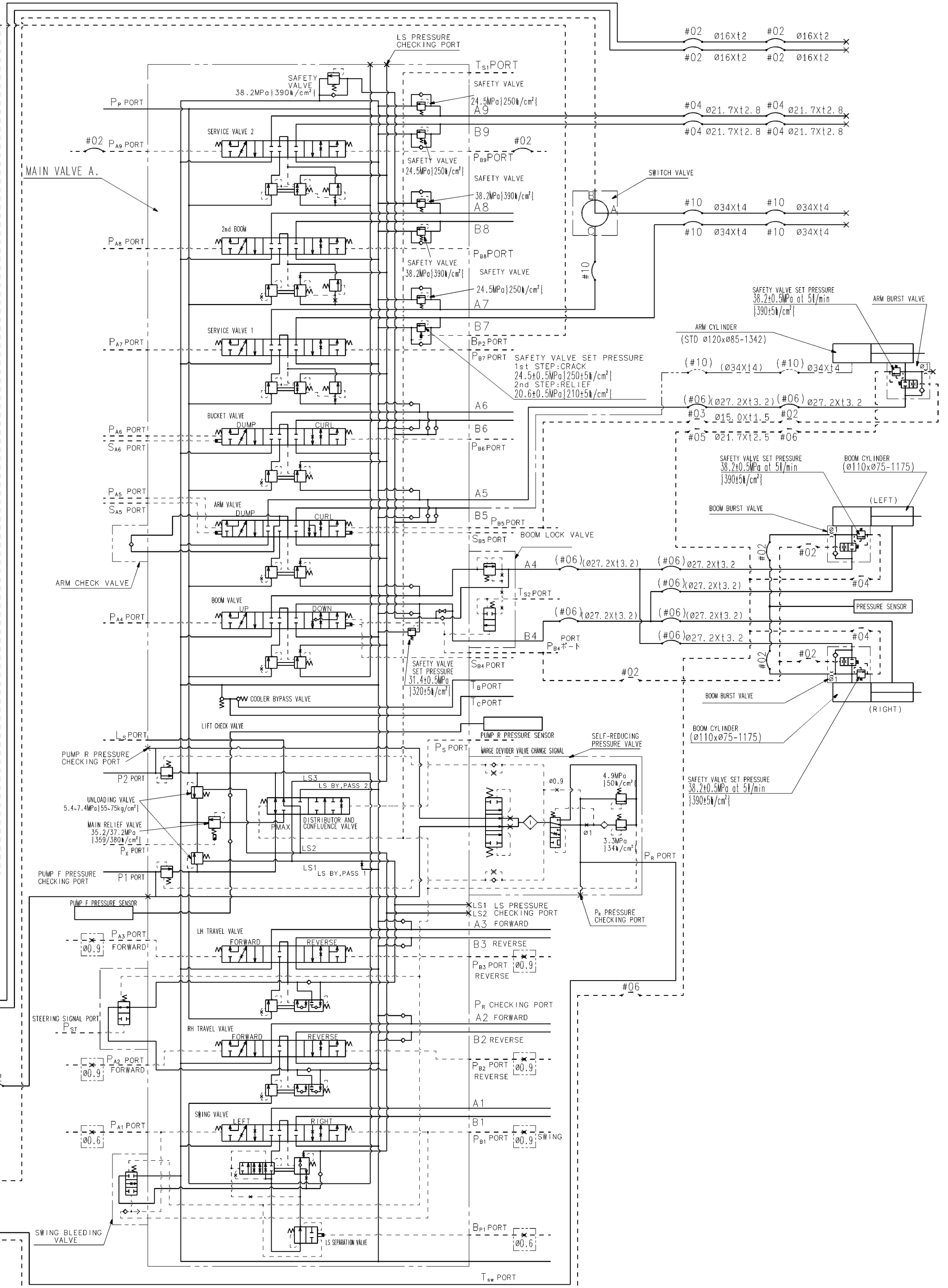
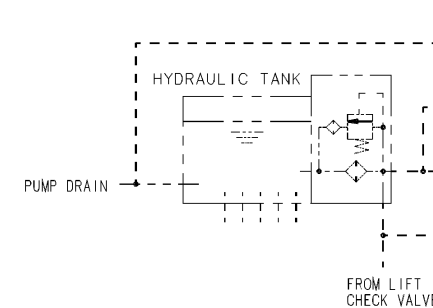
USA
SPEC



EN01912-01
3

Hydraulic circuit diagram 2/2
PC160LC-7E0, PC180LC/NLC-7E0

EU SPEC
REFER TO PAGE 1 FOR OTHER PORTIONS



PC160LC-7E0, PC180LC/NLC-7E0 Hydraulic excavator

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HYDRAULIC EXCAVATOR

PC160LC-7E0
PC180LC-7E0
PC180NLC-7E0

Machine model	Serial number
PC160LC-7E0	K45001 and up
PC180LC-7E0	K45001 and up
PC180NLC-7E0	K45001 and up

90 Diagrams and drawings

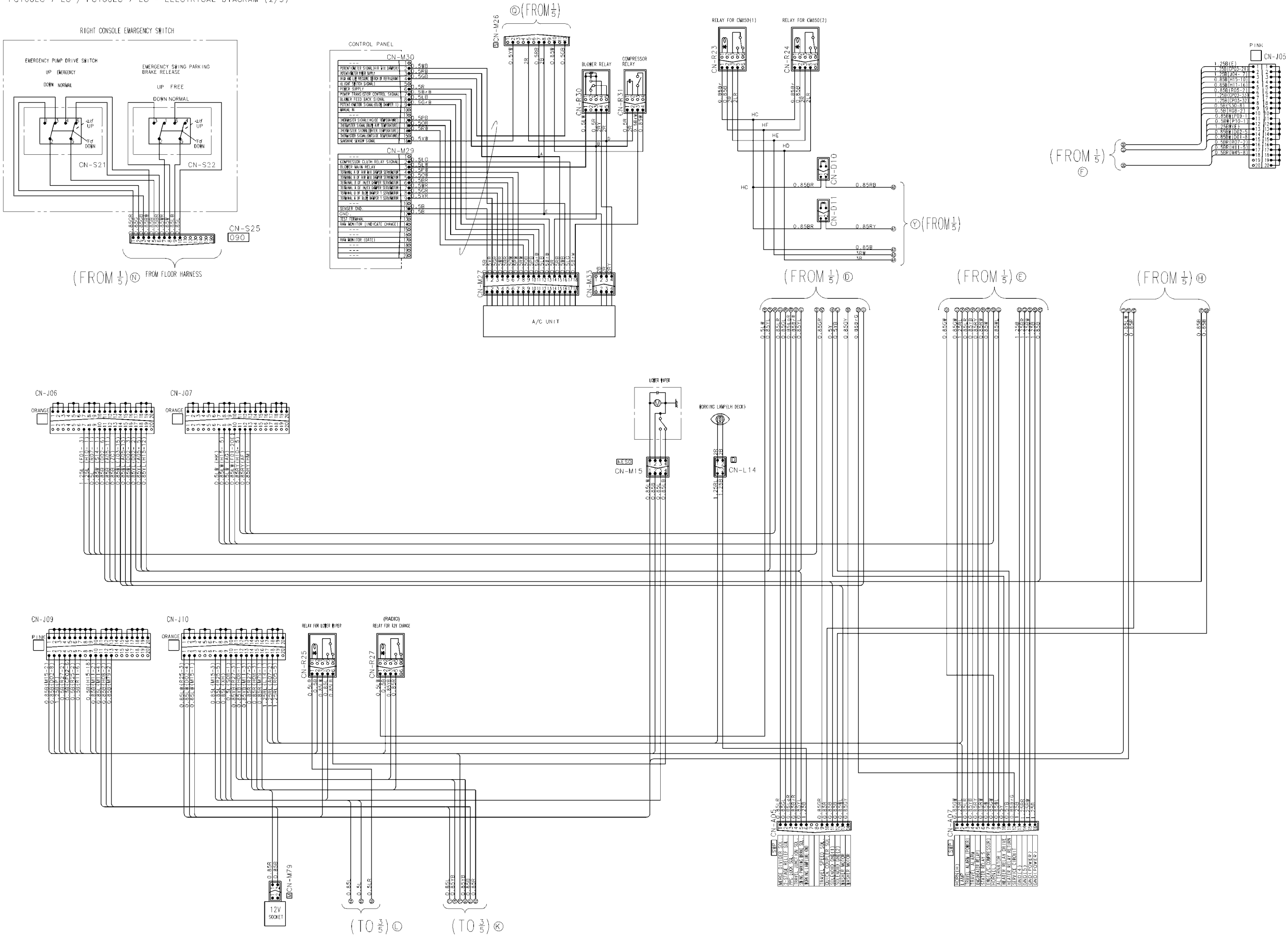
Electrical circuit diagram

Electrical circuit diagram (1/5).....	3
Electrical circuit diagram (2/5).....	5
Electrical circuit diagram (3/5).....	7
Electrical circuit diagram (4/5).....	9
Electrical circuit diagram (5/5).....	11
Connector arrangement diagram	13

Electrical circuit diagram (1/5)
PC160LC-7E0, PC180LC/NLC-7E0

Electrical circuit diagram (2/5)

PC160LC-7 EO / PC180LC-7 EO - ELECTRICAL DIAGRAM (2/5)



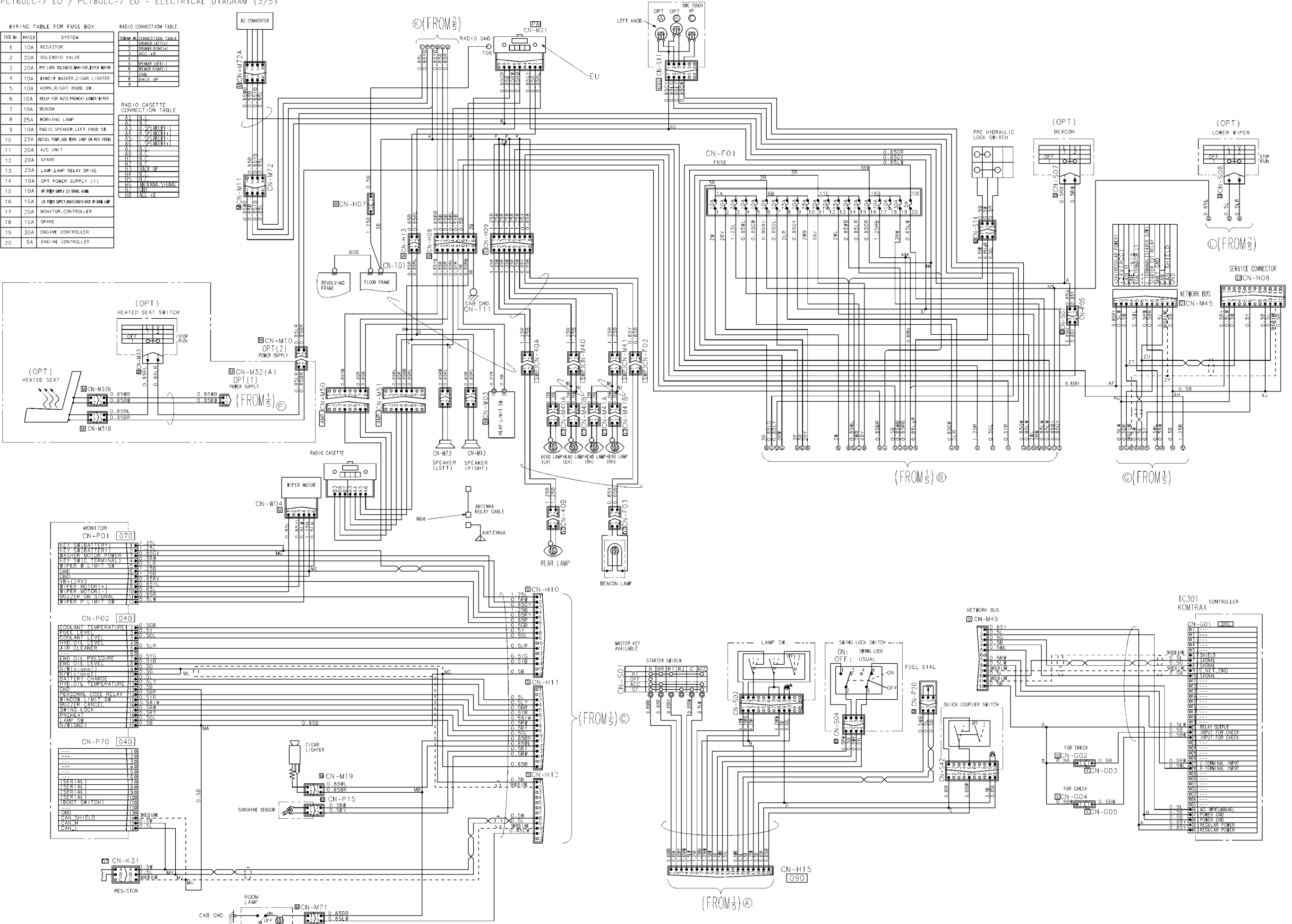
Electrical circuit diagram (2/5)
PC160LC-7E0, PC180LC/NLC-7E0

PC160LC-7 E0 / PC180LC-7 E0 - ELECTRICAL DIAGRAM (3/5)

FUSE NO.	RATED	SYSTEM
1	10A	RESISTOR
2	20A	SOLENOID VALVE
3	20A	PPC LOCK SOLENOID, MONITOR, WIPER MOTOR
4	10A	WINDSH WASHER, CIGAR LIGHTER
5	10A	HORN, RIGHT KNOB SW.
6	10A	RELAY FOR AUTO PRECAT, LOWER WIPER
7	10A	BEACON
8	25A	WORKING LAMP
9	10A	RADIO, SPEAKER, LEFT KNOB SW.
10	25A	REFUEL PUMP, WORK LAMP ON REV FRAME
11	20A	A/C UNIT
12	20A	SPARE
13	25A	LAMP, LAMP RELAY DRIVE
14	10A	OPT POWER SUPPLY (1)
15	10A	OPT POWER SUPPLY (2) BANG KNOB
16	10A	12V POWER SUPPLY, AUTO, REO, BACK UP, ROOM LAMP
17	20A	MONITOR, CONTROLLER
18	10A	SPARE
19	30A	ENGINE CONTROLLER
20	5A	ENGINE CONTROLLER

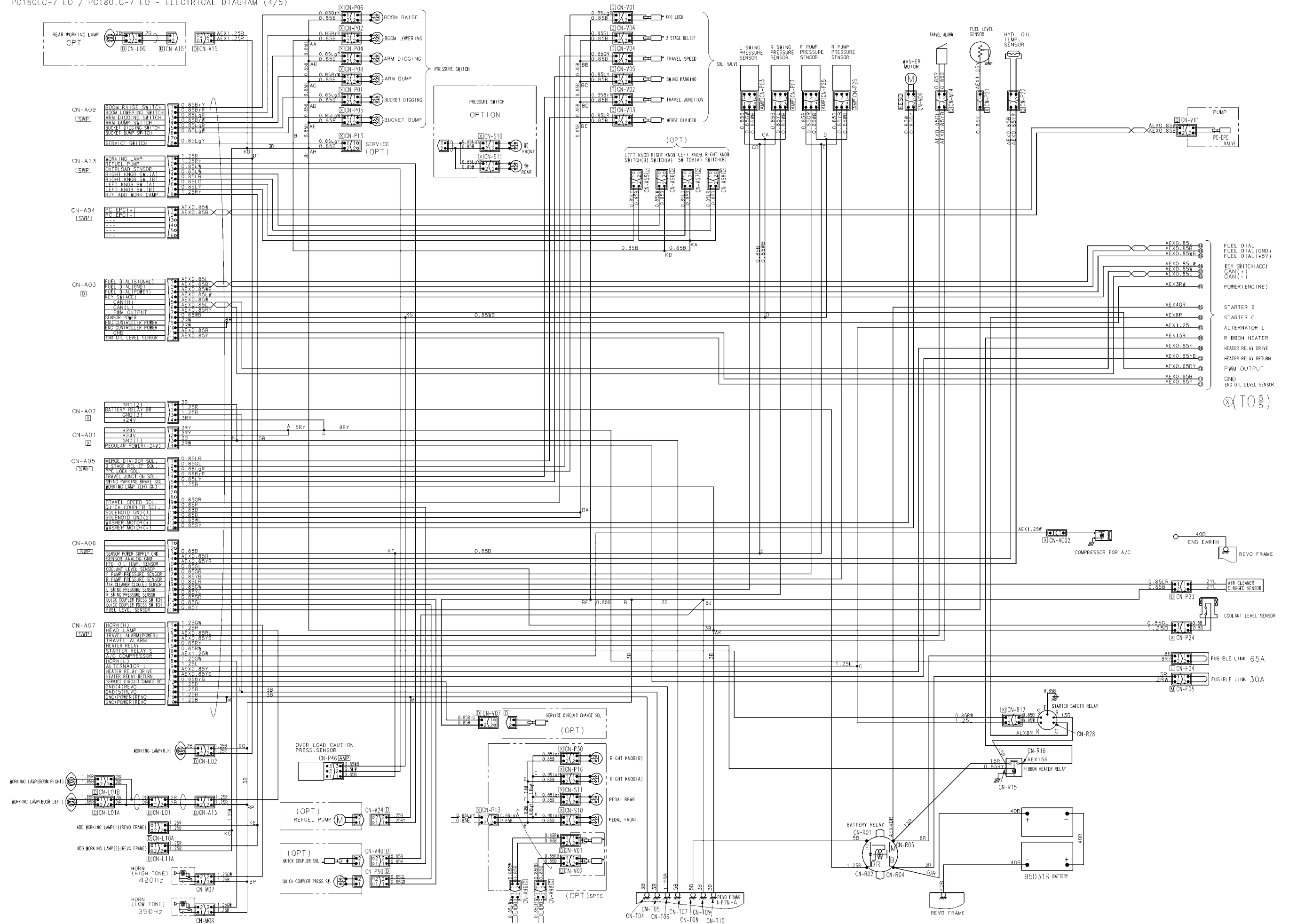
CONNECTION TABLE
1. SPARKER (LEFT)
2. SPARKER (RIGHT)
3. A/C UNIT
4. SPARKER (LEFT)
5. SPARKER (RIGHT)
6. SPARKER (RIGHT)
7. SPARKER (LEFT)
8. BACK UP
9. SPARKER (LEFT)

RADIO CASSETTE CONNECTION TABLE
A1. N.C.
A2. SPARKER (LEFT)
A3. SPARKER (RIGHT)
A4. SPARKER (LEFT)
A5. SPARKER (RIGHT)
A6. SPARKER (RIGHT)
A7. SPARKER (LEFT)
A8. N.C.
A9. N.C.
A10. N.C.
A11. N.C.
A12. N.C.
A13. N.C.
A14. N.C.
A15. N.C.
A16. N.C.
A17. N.C.
A18. N.C.
A19. N.C.
A20. N.C.



Electrical circuit diagram (4/5)

PC160LC-7 EO / PC180LC-7 EO - ELECTRICAL DIAGRAM (4/5)

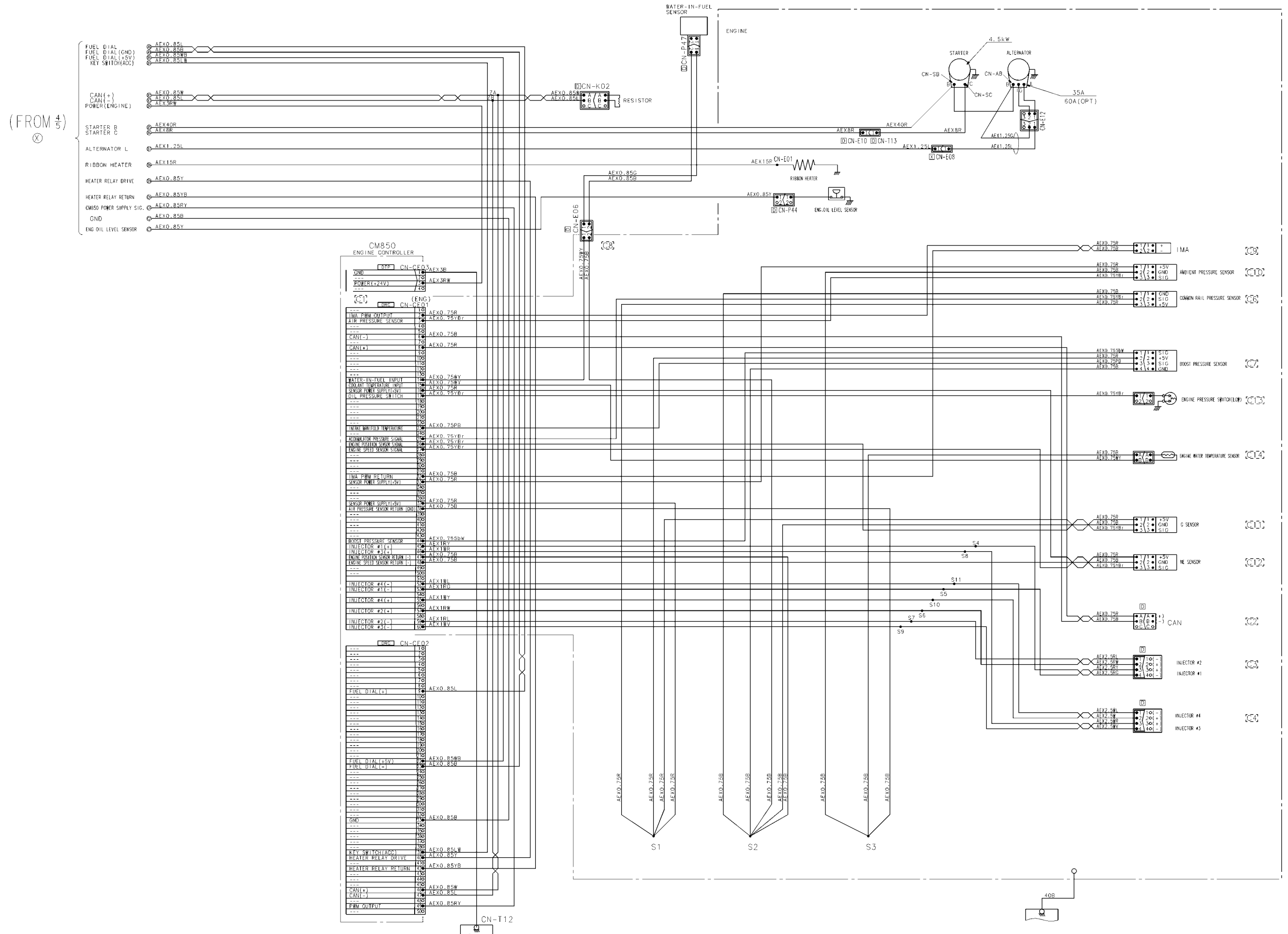


Electrical circuit diagram (4/5)
PC160LC-7E0, PC180LC/NLC-7E0

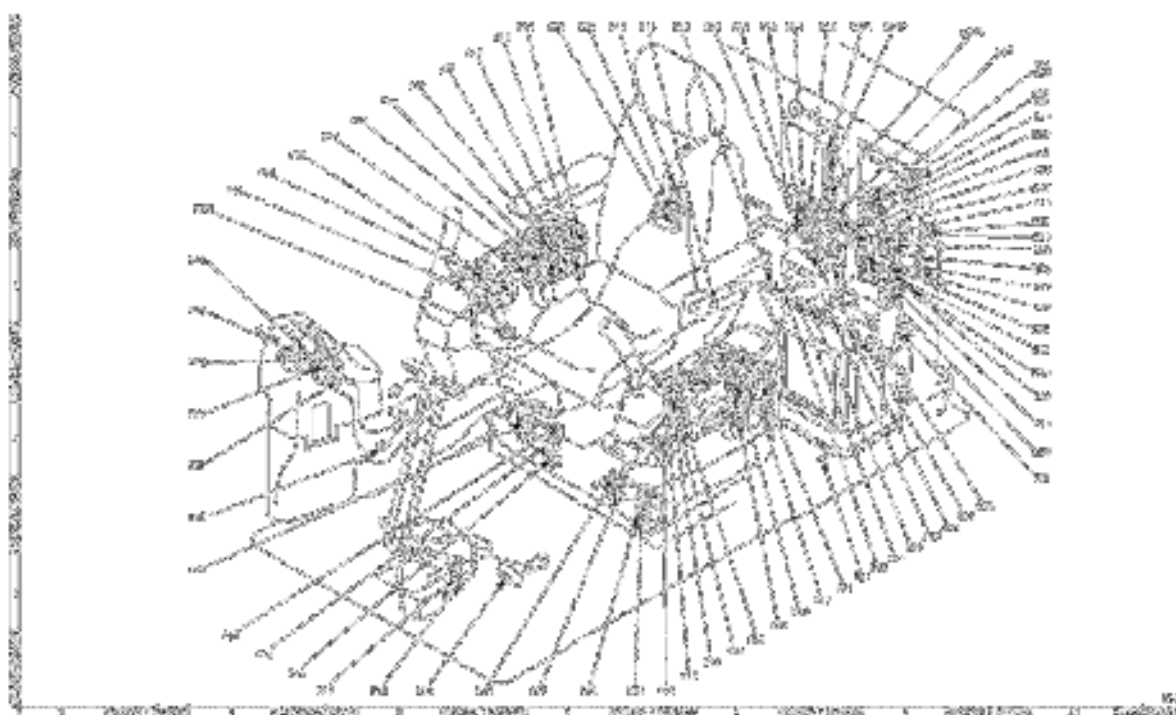
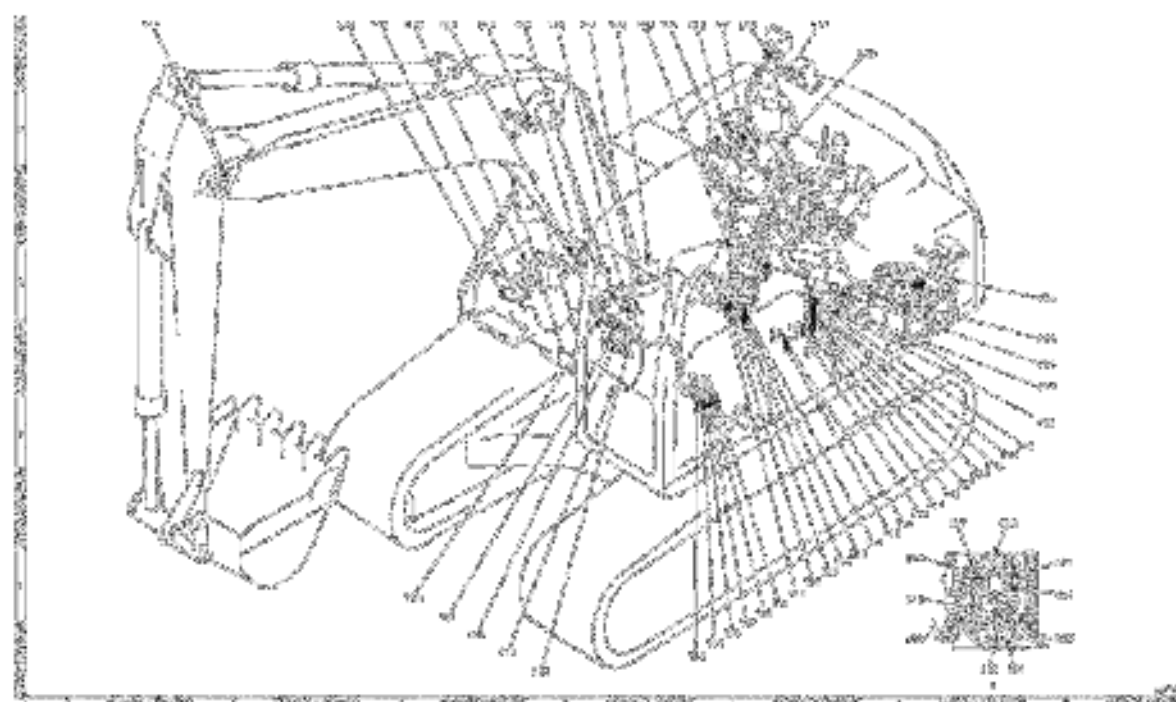
Electrical circuit diagram (5/5)

PC160LC-7 EO / PC180LC-7 EO - ELECTRICAL DIAGRAM (5/5)

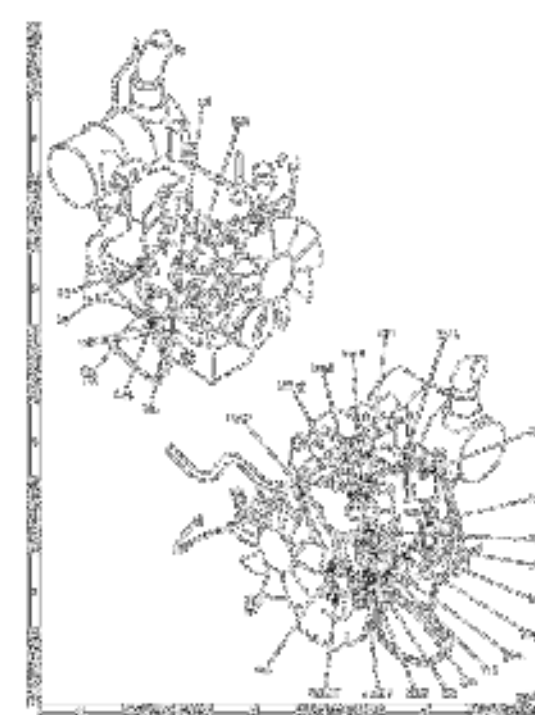
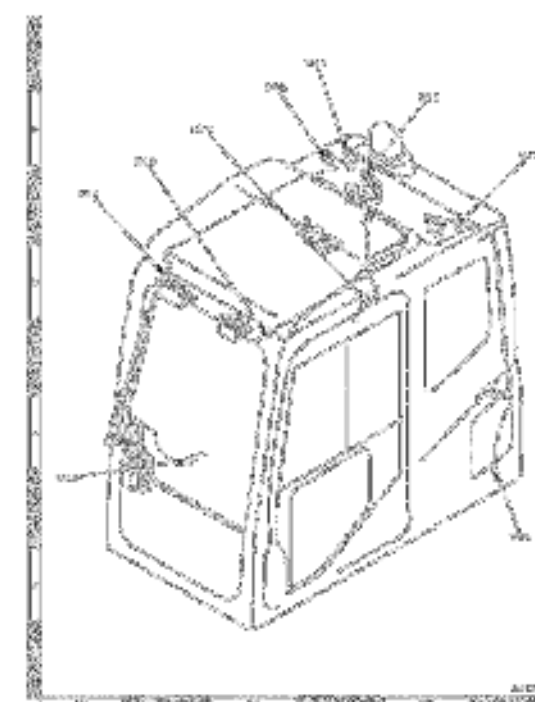
Electrical circuit diagram (5/5)
PC160LC-7E0, PC180LC/NLC-7E0



Connector arrangement diagram

[illegible][illegible]

Connector arrangement diagram PC160LC-7E0, PC180LC/NLC-7E0



PC160LC-7E0, PC180LC/NLC-7E0 Hydraulic excavator

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